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ABSTRACT

This document contains technology-based learning activities for the Illinois communication technology course at the orientation level (grades 9 and 10). This packet includes a course rationale, course mission statement, course description, course outline, suggested learning objectives for each of the transportation areas, and suggested learning experiences. The packet also contains 32 developed learning activities. The content can be presented through short lectures, discussion, media, demonstrations, or hands-on activities. The course units can follow either a 9- or an 18-week format. There are six units in this course: introduction to communication technology, drafting and design, photography, graphic arts, processing and communicating information with computers and computer applications, and telecommunications technology. Each unit may contain suggested learning objectives and learning activities. Each activity within a unit contains some or all of the following sections: introduction, materials and supplies list, activity procedures, activity analysis, various kinds of drawings and other graphics, teaching aids, and student handouts. (NLA)

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Illinois
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Department of
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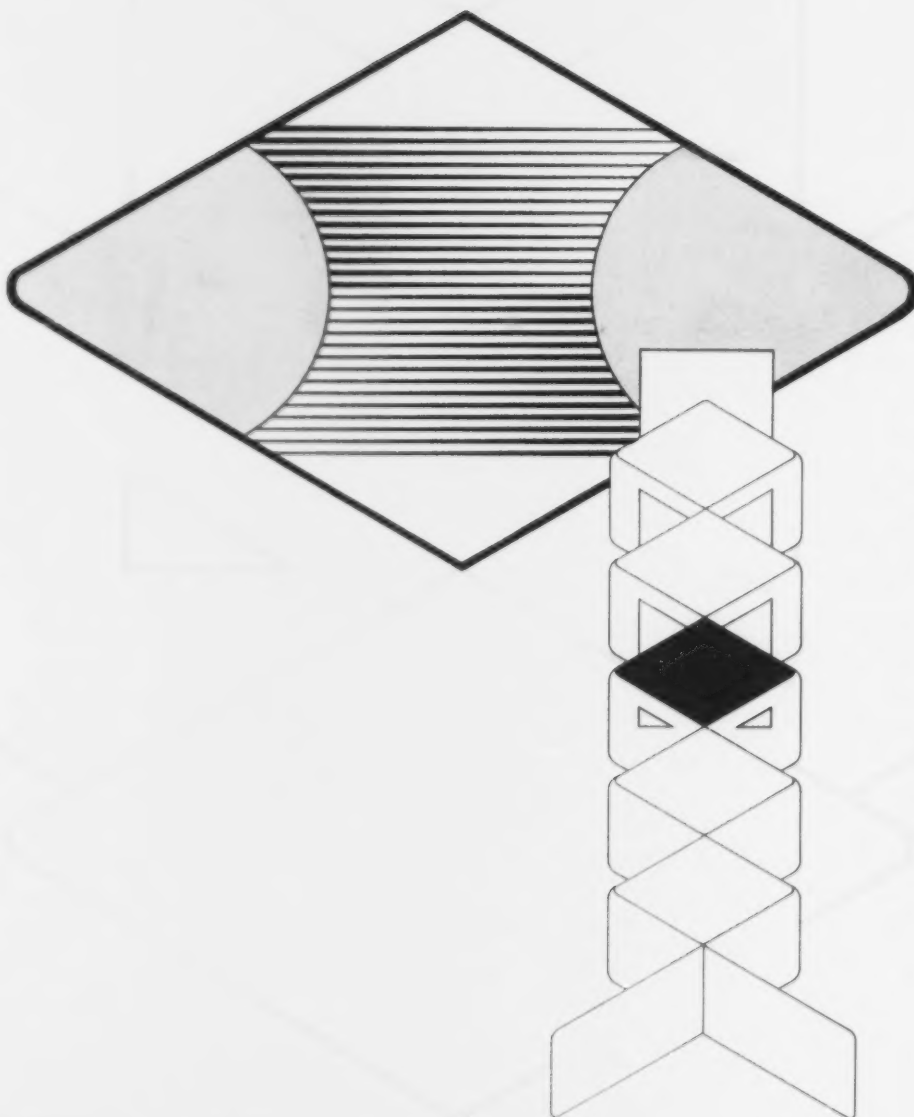
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HOW TO USE THE PACKET

This packet contains technology-based learning activities for the Communication Technology course at the orientation-level (grades 9 and 10) of the Illinois Plan for Industrial Technology Education curriculum project. The materials supplement the 1989 Illinois Plan Orientation Curriculum Guide and were developed to complement hands-on workshops.

The materials were designed to enable teachers attending the hands-on workshops to implement the activities at their home school. Workshop participants are encouraged to use the materials as a model for future curriculum development.

The Communication Technology Activity Packet includes a course rationale, course mission, course description, course outline, suggested learning objectives for each of the transportation areas, and suggested learning experiences.* The packet also contains 32 developed learning activities. Several of the activities have been collected from earlier activity packets developed by the project. The packet also contains several newly developed activities. These include activities like Bar Coding and Computer Imaging.

When implementing these activities, it is important to teach the resources, technical processes, industrial applications, and technical impact for each technology education topic. By including content from each of these areas, students are ensured a complete orientation. Content should also address integrated skills like transition skills, generalizable skills, and vocational ethic skills, as well as the State Goals for Learning. The content can be presented through short lectures, discussion, media, or demonstrations. However, most of the time should be spent on hands-on learning activities.

The following abbreviations are used in this document:

TA = Teaching Aid
SH = Student Handout
DR = Drawing

Acknowledgment

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* Information taken from the 1989 Illinois Plan Orientation Curriculum Guide.

COMMUNICATION TECHNOLOGY

Course Rationale

It has been said that our society is in the midst of an "Information Age." This statement is based on the rapid development of communication technology over the past several decades.

Examples of communication technology can be seen throughout all facets of our daily lives, from making routine phone calls, printing newspapers, or broadcasting television programs. Those daily events have been available for quite some time, but the means by which they are done or the method by which they are made available has changed dramatically. Today's phone calls can be made on the move using cellular phones. Phone calls can be networked allowing simultaneous communication from various locations in the world. Newspaper articles can be written and quickly edited using computers and desktop publishing programs. Once the newspaper is completed, it can be sent over fiber optic cable and displayed on a home monitor. Satellite and cable television can provide us access to instant news coverage, a wide variety of entertainment programs, and an opportunity to obtain an education at home.

Through the development of the computer, communications technologies like drafting, graphic arts and photography have undergone significant change. Computers have made it possible for designers to create computer-aided drawings that can be edited quickly, rotated to any angle, magnified to various sizes, and displayed in full 3-D. Computer technology has replaced tedious and time consuming graphic arts processes with accurate and efficient laser printers. Automatic cameras now make it possible for everyone to take pictures like a professional. Video recorders and cameras enable people to record and again experience important events.

Since the capabilities of existing communication systems has expanded so rapidly, it has become increasingly important to learn how to utilize technology to record, send, receive, and process information. We are living in an "Information Age" and have become a society that seeks new and better ways to communicate. It is education's responsibility to teach students how to adapt, cope, and use this new emerging technology.

Course Mission

The purpose of the Communication Technology course is to orient students to the basic resources, technical processes, industrial applications, and technological impacts in both graphic and electric means of transmitting and receiving information. The course will help students to:

- * use and understand the verbal and symbolic language used to describe communication systems and phenomenon;
- * develop and present creative solutions to present and future communication problems;

- * identify and investigate potential career opportunities in the area of communication;
- * understand the evolution of communication technology and its influence on our culture; and
- * safely use common tools, materials and processes to design, build, and test communication systems.

Course Description

The Communication Technology course includes units on drafting and design, photography, graphic arts, telecommunication, and processing and communicating information with computers. Each unit will involve students in a wide range of learning activities and experiences. Include things like generating a simple floor plan, conducting a photo session, reproducing a graphic product, creating computer-aided graphics, and making a video tape.

Course Outline

In the spirit of orientation, students should be introduced to a wide range of graphic and electronic communication technologies. The following course outline lists the recommended units for either a nine or an eighteen week format. Potential lesson topics are provided under each unit title. Each lesson should embrace as many of the unit objectives as possible. In a nine week format, an emphasis should be placed on the terminology, resources, processes, applications, impacts, career and safety concepts that relate to the lesson topic.

Sample Communication Technology Course Outline

- I. Introduction to Communication Technology
- II. Drafting and Design
 - A. Sketching
 - B. Multiview
 - C. Pictorial
 - D. Architectural
 - E. Charts and Graphs
 - F. Schematics
 - G. Maps
- III. Photography
 - A. Cameras and film
 - B. Photographing subjects
 - C. Processing photographs
 - D. Presenting photographs
- IV. Graphic Arts
 - A. Graphic arts enterprises
 - B. Establishing formats
 - C. Writing messages

- D. Illustrating messages
 - E. Preparing and processing copy
 - F. Reproducing graphic products
 - G. Distributing graphic products
- V. Processing and Communicating Information with Computers
- A. Hardware
 - B. Software
 - C. Applications
- VI. Telecommunication
- A. Telephone
 - B. Radio
 - C. Television
 - D. Fiber Optics
 - E. Satellites

Adapting the Communication Technology Course Outline to Nine or Eighteen Week Formats

Hands-on learning activities are one of the most powerful ways of helping students learn about technology. Unfortunately, they are very time consuming. The following strategies can be employed to use available laboratory time more efficiently without sacrificing important unit objectives:

- * Divide the class into small groups and assign each group a different learning activity related to the lesson topic. When each group has finished their assigned activities, have students present their experiences to the rest of the class. For example, during the computer unit, have each group use and present a software package designed for a given application.
- * Avoid assigning complex laboratory activities when simpler activities will enable students to experience important concepts and achieve the desired objectives. For example, during the graphic arts unit, have students design and reproduce a poster instead of a multi-page newsletter.
- * Prepare work stations that organize the tools and materials needed to conduct laboratory activities prior to class. For example, during the telecommunication unit, develop radio kits that students can assemble and test.
- * Have students experience a wide range of concepts through one or two robust learning activities. For example, during the telecommunications unit, have students make a video tape. Discuss how the basic parts of a television system (e.g., input transducer, transmitter, link, receiver, output transducer) transfer to radio and telephone communication systems.

During an eighteen week format, students can engage in more complex learning activities and experience given topics in greater depth. In addition, there is an opportunity to provide a wider range of learning experiences. The study of technology allows for an infinite number of learning experiences. Therefore, it is important to select and implement learning activities in an efficient manner.

INTRODUCTION
TO
COMMUNICATION
TECHNOLOGY

INTRODUCTION TO COMMUNICATION TECHNOLOGY

Suggested Learning Objectives

Upon completion of the introduction to communication technology unit, students will be able to:

- A. Define and properly use common communication technology terminology like transmitter, link, receiver, symbol, format, encode, decode, audience, and media.
- B. Describe and apply a communication model featuring a sender, encoding, transmitting, link, receiving, decoding, receiver, and a feedback loop to common graphic and electronic communication systems. LA4
- C. Categorize common communication technologies like radio, television, drafting, photography as graphic or electronic systems.
- D. Categorize common communication technologies like newspapers, telephones, magazines, and citizen band radios as one-way or two-way communication systems.
- E. Discriminate between passive and active forms of communication technology.
- F. Identify basic applications for communication technology including recording, educating, entertaining, describing, informing, and persuading.
- G. Evaluate the societal and environmental impacts associated with communication technology including the exchange of information between cultures, noise pollution, and utilization of natural resources. SC2
- H. Forecast the consequences of poor communication and describe technological strategies for improving communication between people. SC2
- I. Select the optimum means of communication for addressing a specific communication problem based on the environment, media, cost, time, and content considerations.

Suggested Learning Activities

- 1. Introduce students to the general communication model (i.e., sender, encoding, transmitting, link, receiving, decoding, receiver, and feedback loop). Divide the class into groups of two and have them set back to back. Provide one member of each team a sheet of paper illustrating several graphic configurations (e.g., stacked rectangles, squares, triangles). Have one student describe one of the configurations while the other students try to draw it. When each team has finished, ask them to compare their drawing with the original. Have students exchange roles and conduct a second round. This time, allow students to provide each other feedback during the communication process. Ask students to evaluate how the game relates to the general communication model, determine where communication broke down, and recommend ways to improve the communication process.

2. Introduce students to a variety of graphic and electronic forms of communication technology. Include things like graphic arts, photography, drafting, radio, television, telephone, and computer technology. Assign each student a topic and ask them to develop a display describing their assigned communication technology topic. Each display should illustrate if the communication technology is graphic or electronic, one-way or two-way, passive or active, and how it fits into the communication model.
3. Discuss how technology is used to solve communication problems. Have students evaluate, select and present the best communication system to address a given communication problem. Possible problems could include things like showing someone how to perform a process, describe an object, and tell a large group of people about an upcoming event. Discuss why given types of communication technology are more appropriate for certain applications than others.
4. Discuss the evolution of communication technology and how it has shaped the way we communicate to one another. Assign small groups of students a time period in history. Have each group research and develop a pictorial timeline illustrating the major developments in communication technology during their assigned time period. When all the groups have finished, link the timelines together. Ask students to evaluate how communication technology has influenced our culture.

AN OVERVIEW OF COMMUNICATION TECHNOLOGY

Introduction

Imagine life without televisions, radios, telephones, books, newspapers or computers. Have you ever stopped to realize how many forms of communication you are exposed to in your daily routine or wondered how communication influences the way you work, live, and play?

SH #1 is an illustration of the communication process. Communication begins with the sender encoding a message. The sender must encode (think) the information and then transmit it by some medium. Encoding becomes input for transmitting the message. The data can be transmitted through either a graphical or electronic medium. This graphical or electronic medium can be sent as either an active two-way system or a passive one-way system. The active two-way system requires the sender to have direct interaction with the receiver. An example would be two people talking on a telephone. As the two people interact during the phone conversation, both parties will assume the role of a sender and a receiver. Passive one-way communication takes place when the sender does not require direct interaction with the receiver (e.g., a radio station). A radio station will transmit a signal without knowledge of exactly who will be receiving the message. If a person decides to turn off the radio, the signal will continue to be sent for others to tune in and listen to. From the medium, someone must receive the information and decode (understand) its meaning. The receiver outputs some type of feedback. The feedback can be direct or indirect. Direct feedback takes place when there is a direct link or interaction between the sender and the receiver. Direct feedback takes place when two people talk on a telephone, one person talks, the other responds, and vice versa. This constant interaction between sender and receiver provides both parties with continuous feedback. During indirect feedback, the sender does not have direct contact with the receiver. For example, ratings provide indirect feedback to the status of TV and radio programming.

SH #2 illustrates how graphic and electronic Communication Technology can be divided into types. Notice, as graphic communication begins to take advantage of new electronic advancements, more and more traditional graphic processes are becoming obsolete. It has been said that someday most graphic processes will be found under the electronics column. Also, as electronic forms of communication advance, ethical questions arise. The statement, "a picture never lies," is no longer true. Computers now have the ability to digitize analog images and bring that image to a monitor. Once the original image is displayed, it can be edited, manipulated, touched up, and modified. The new image can then be changed back to an analog image just like the original. What are the implications of this type of advancing technology?

As you begin to learn about Communication Technology, you need to understand the tremendous influence communication has in your everyday life. It has been said, on average, you will spend one and one-half years of your life watching television commercials, each trying to change your opinion or convince you to buy a certain type of product. What impact will this have on you and our society? Today's students must be able to answer this type of question. You must learn to evaluate the impact of this type of communication technique and be able to assess new emerging techniques yet to come.

This Technology Education Activity will introduce you to the main themes and concepts found throughout the Communication Technology course. In this activity, the students will be developing a poster that describes a communication topic. The posters can be used to develop a large wall display or placed into a communication booklet to which students can refer throughout the course.

Materials and Supplies

Provide each student access to:

- construction paper
- rubber cement
- scissors
- straight edge
- tape
- markers
- stencils
- a variety of communication-related resource materials (e.g., magazines, textbooks, encyclopedias).

NOTE: If available, a computer and a popular graphic software package can be used to enhance the appearance of the display.

Activity Procedures

1. Obtain a communication topic from your instructor.
2. Collect the information found on your activity worksheets (SH #4). To gather information on your topic, use sources like magazines, textbooks, and encyclopedias.
3. Once the information has been collected, the next step is to complete the Communication Technology Data Collection sheet (SH #4). Be sure to include a logo design, topic description, and answers to each question. Make sure your logo is easy to recognize, simple in design, in good taste and graphically describes your topic.
4. Before transferring the new information to your final poster design sheet (SH #5), obtain the approval of your instructor.
5. Complete your final poster design. Be sure all questions on the sheet are answered completely and the information is neatly presented.
6. Present your information to the rest of the class.
7. Turn in your poster design to be evaluated

Activity Analysis

Directions: Circle the best answer or fill in the blank with the correct answer.

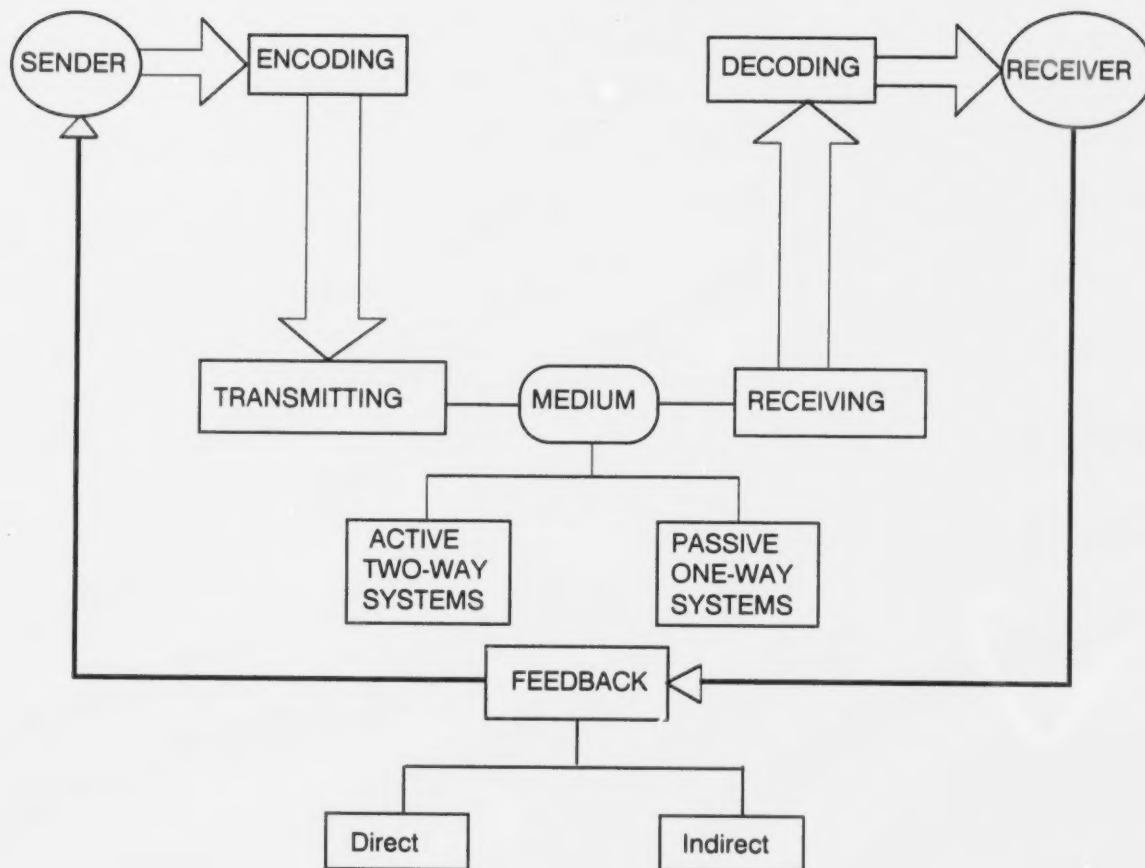
1. Which one of the following communication topics is a graphic form of communication?
 - A. Cellular phone
 - B. Computer-aided drafting
 - C. Newspapers
 - D. Electronic publishing
2. Newspapers and magazines are examples of _____.
 - A. Passive one-way systems
 - B. Active two-way systems
3. Cordless phones and citizen band radios are examples of _____.
 - A. Passive one-way systems
 - B. Active two-way systems
4. Radio, computers, and magazines are examples of _____.
 - A. transmitters
 - B. mediums
 - C. receivers
 - D. feedback
5. A telephone conversation is an example of indirect feedback.
 - A. true
 - B. false
6. The first steps in the communication process is _____.
 - A. providing feedback.
 - B. transmitting the message through a medium
 - C. decoding the message
 - D. encoding the message
7. List two graphic forms of communication technology.
 - A. _____
 - B. _____
8. List two electronic forms of communication technology.
 - A. _____
 - B. _____

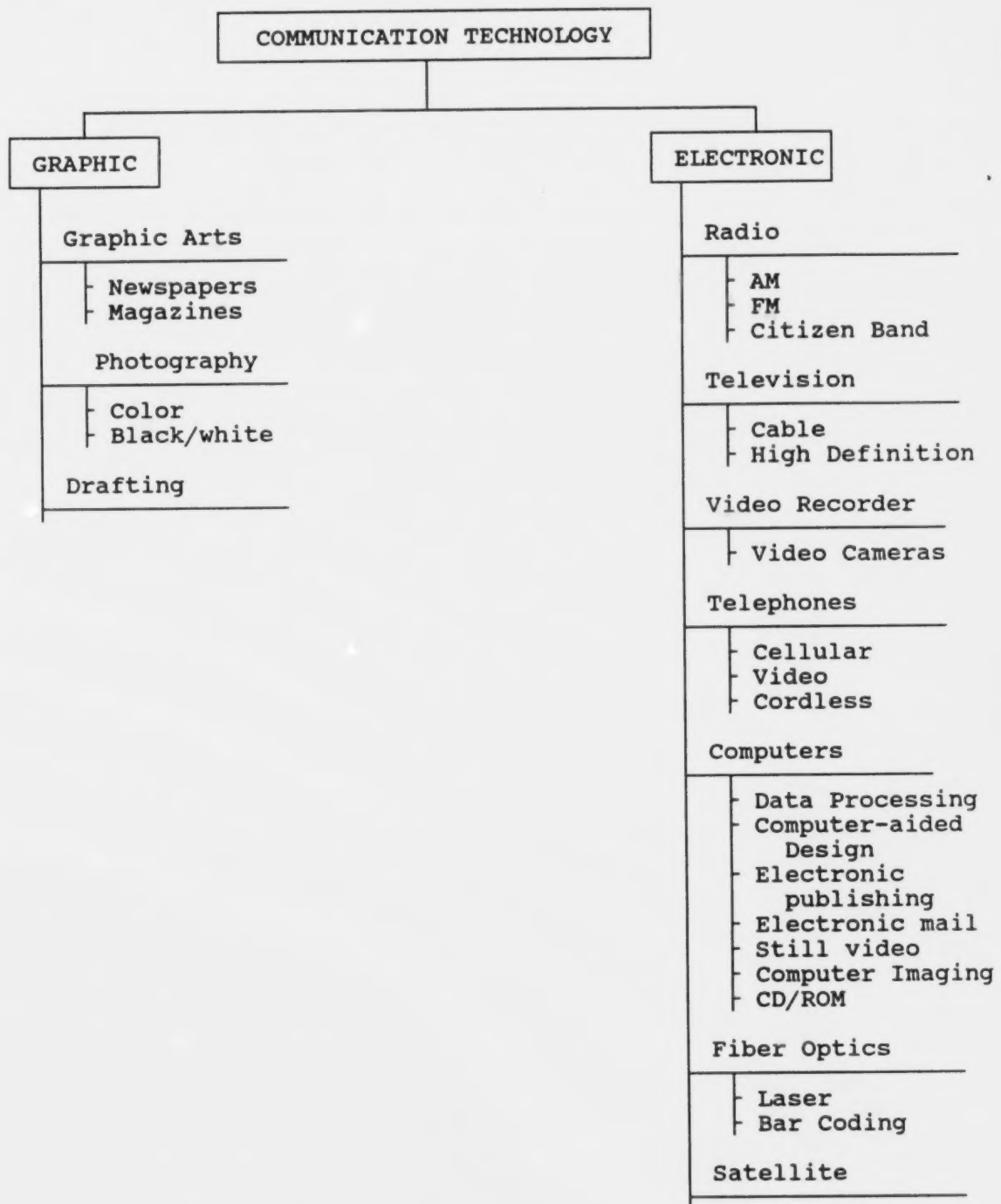
9. What impact are computers having on the way we communicate?

10. What are the ethical implications of manipulating printed images by computers?

11. How will advances in Communication Technology change the way we work, live, and play in the future?

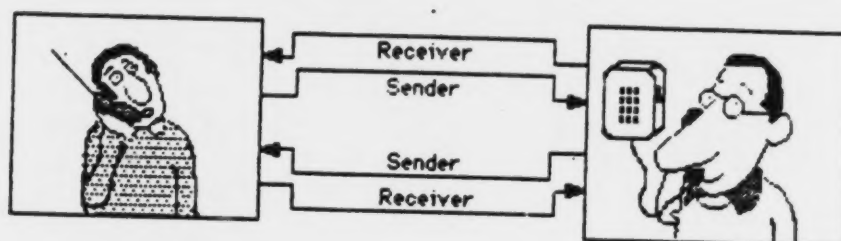
COMMUNICATION MODEL



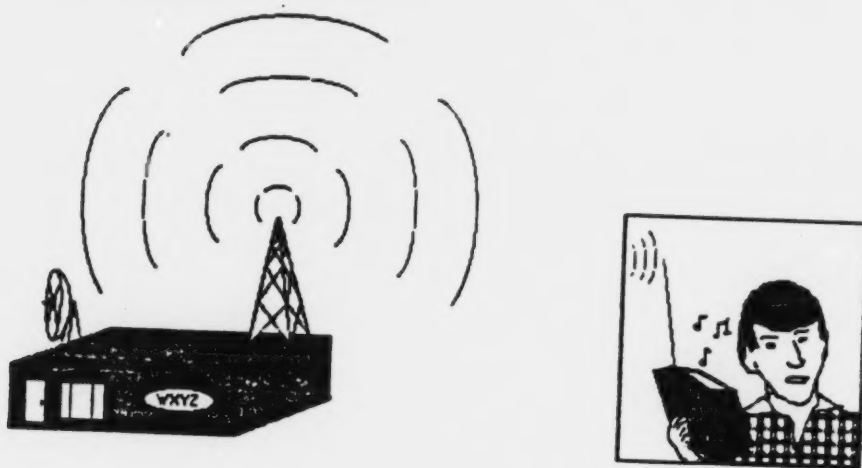


ACTIVE - TWO-WAY SYSTEMS:

Require the sender to have direct interaction with receiver.

**PASSIVE - ONE-WAY SYSTEMS:**

The sender does not have direct interaction with the receiver.



AN OVERVIEW OF COMMUNICATION TECHNOLOGY**Data Collection Sheet**

Student's Name _____ Topic Name _____

1. Define or describe your topic.

Reference Sources

2. How is your topic being used and where is it being applied in our society?

Reference Sources

3. Describe if your topic is graphical or electronic.

Reference Sources

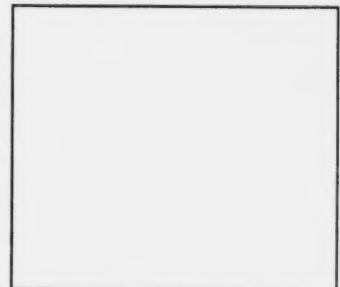
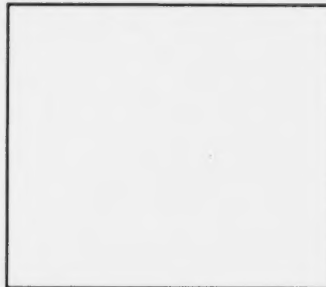
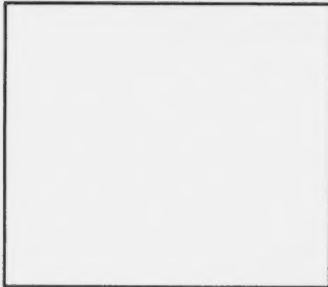
4. Is your topic a passive one-way or active two-way communication system.

Reference Sources

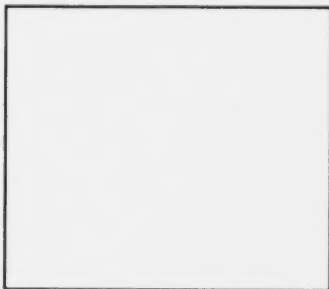
5. What potential impact will your topic play in providing communication in the future?

Reference Sources

6. Use the boxes below to develop three communication logo sketches. Make sure your logo designs are easy to recognize and simple in design.



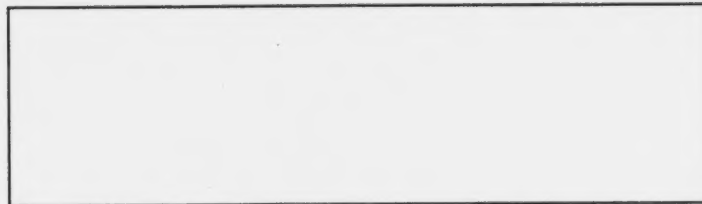
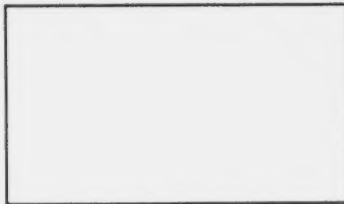
7. From the sketches above, create one refined logo.



AN OVERVIEW OF COMMUNICATION TECHNOLOGY

Student Worksheet

Final Draft



COMMUNICATION LOGO

COMMUNICATION TOPIC DESCRIPTION

1. Categorize your communication topic as graphic or electronic. Explain why you have students select the category.

2. Is your communication topic a passive one-way or an active communication system? Explain.

3. How is your topic used and applied in our society?

4. List the careers that are associated with your topic.

5. What potential role will your topic play in providing communication in the future?

DRAFTING AND DESIGN

DRAFTING AND DESIGN

Suggested Learning Objectives

Upon completion of the drafting and design unit, students will be able to:

- A. Define and properly use common drafting and design **terminology** like orthographic, modeling, oblique, plot, radius, and project. MA6
- B. Identify basic **applications** for drafting and design like communicating detailed information, specifying products and structures, illustrating assembly and servicing procedures, and describing electrical and fluid power circuits. MA6
- C. Describe the major milestones in the **history** and evolution of drafting and design technology including the development of measuring units, introduction of photochemical reproduction techniques, and integration of computer-aided drafting and design systems. SS2
- D. Describe the basic drafting and design **processes** like centering, dimensioning, drawing, designing, reproducing, plotting, digitizing, formatting, presenting, lettering, layering, and reproducing.
- E. Describe the basic human, material, natural, informational, financial, and technological **resources** associated with drafting and design processes and enterprises (e.g., paper, specifications, computers).
- F. Identify potential **safety** hazards, establish guidelines for safe behavior, and adhere to common safety practices when around or participating in drafting and designing activities. PH3
- G. Discuss the **career** opportunities in design and drafting technology (e.g., architect, CAD system operator, technical illustrator) based on their interests, talents, and career expectations.
- H. Describe the societal and environmental **impacts** associated with drafting and design like creating solutions to problems, promoting efficient action, and facilitating artistic expression. SC2
- I. Prepare and translate a variety of pictorial drawings that illustrate and specify objects, structures, data sets, systems, and processes. MA6
- J. Prepare and interpret graphs that illustrate and specify trends, facilitate comparisons, and show relationship within a given set of data. MA 7
- K. Prepare and translate multiview drawings that illustrate and specify components and assemblies. MA 6

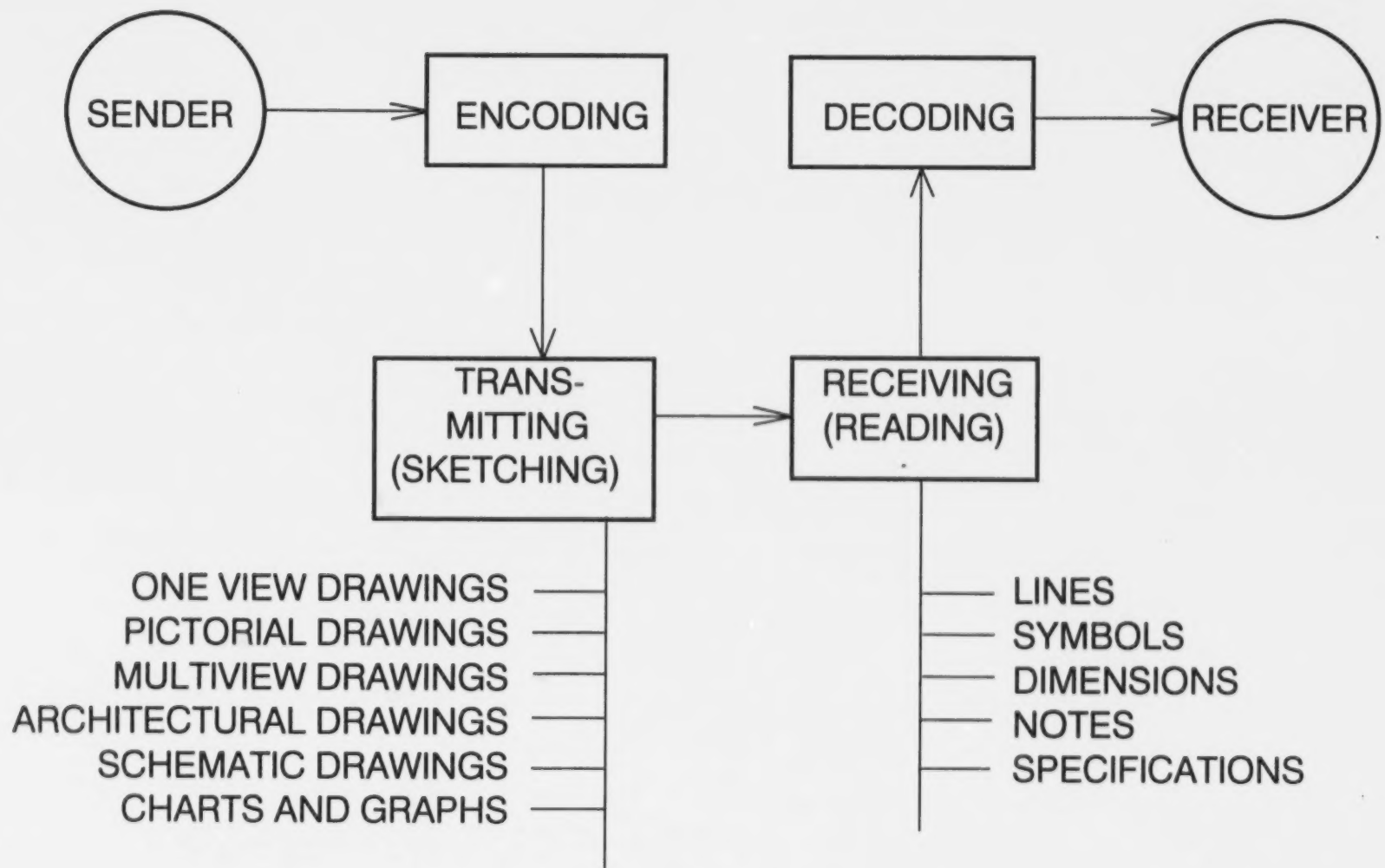
- L. Prepare and translate architectural drawings that illustrate and specify architectural sites, plans, structural details, and utility and climate control systems. MA6
- M. Prepare and translate schematic drawings that illustrate and specify electrical and fluid power circuits and components. MA6
- N. Prepare and translate maps that illustrate and specify geographic features, distances, locations, and routes. MA6
- O. Prepare and translate charts that illustrate and specify organizations and procedures. MA7
- P. Use common traditional and computer-aided drafting and design tools to prepare pictorial drawings, architectural drawings, multiview drawings, schematics, charts, graphs, and maps. PH6
- Q. Follow common drafting and design conventions when preparing pictorial drawings, architectural drawings, multiview drawings, schematics, charts, graphs, and maps.
- R. Select and defend the best drafting or design techniques for illustrating and specifying a given data set, object, procedure, system, or structure. MA6
- S. Prepare and translate basic bills of materials, schedules, parts lists, notes, and specifications. LA1
- T. Produce three-dimensional objects based on two-dimensional communication media and prepare two-dimensional communication media based on three-dimensional objects. MA6

Suggested Learning Activities

1. Discuss how drafting is used to communicate three dimensional information using two dimensional media. Provide each student a three dimensional mock-up for a simple object. Have each student draft a multiview drawing for their assigned object. When they have finished, have students exchange and use the drawings to make the objects using an easy-to-shape material (e.g., soap, clay, styrofoam). Compare and contrast the mock-ups made from the drawings with the originals. Have students identify discrepancies between mock-ups and troubleshoot the communication process. Ask students to identify the consequences of poor communication (e.g., wasted time, money, and materials) and suggest strategies for ensuring accurate communication (e.g., conventions, standards, proofing, computer-aided design/drafting).
2. Discuss how multiview drawings can be used to describe a product to be manufactured. Have students use traditional or computer-aided drafting tools to design and prepare plans for a simple product (i.e., business card holder, machine part, memo pad holder). Include processes like determining the number of views, assigning dimensions, developing a bill of materials, and providing notes and specifications. Ask students why neatness and accuracy are important when drafting plans for an object.

3. Discuss how architectural drawings are used to describe a structure to be constructed. Have students use traditional or computer-aided drafting tools to design and prepare a site, foundation, and floor plan for a simple structure (e.g., vacation house, storage building, room addition). Include processes like dimension interior and exterior features, drawing structural details, and providing schedules. Discuss the differences between mechanical and architectural drawings.
4. Introduce students to the concept of geometric modeling. Demonstrate how to create and manipulate geometric models for a product or structure using computer-aided design technology. Have students use a geometric modeling or drafting program to create a skeleton view of an object. Have students rotate, view and print the object from several perspectives. Ask students to describe the implications of being able to manipulate and test a geometric model during the design process.
5. Discuss how line graphs can be used to communicate given types of information graphically. Provide students sales information for fictitious companies. Have students use traditional drawing tools or a business graphics program to create line graphs illustrating the number of products sold each month for one year. Use the graphs to identify sales patterns or trends.
6. Explain how graphs can be used to make comparisons. Provide students quality control information for fictitious companies. Have students use traditional drafting tools or a business graphics program to develop bar graphs illustrating the number of defective products produced each day. Use the graphs to evaluate and identify when quality control efforts need to be stepped up.
7. Discuss how pie graphs help people understand how something is divided into smaller groups. Provide students information regarding how energy is used in the United States. Using traditional drafting tools or a business graphics program, have students make pie graphs illustrating what percentage of our energy resources are used for industrial, transportation, residential, and commercial applications. Use the graphs to identify which applications use the most energy.
8. Discuss how charts can be used to illustrate a sequence of operations. Using traditional or computer-aided drafting tools have students develop flow charts illustrating the steps needed to produce or service a simple product. Discuss how flow charts are used to develop and communicate computer programs, production sequences, and trouble shooting procedures.
9. Provide students a table of information describing the cost, specifications, and performance characteristics for automobiles in various categories. Have small groups of students prepare a series of graphs to explain and describe the automobiles in the table. Encourage students to use appropriate graphs to communicate things like number of compact, intermediate, and full size cars; the relationship between engine size and quarter mile speed; and the average gas mileage for cars in each category. Ask students to identify and evaluate solutions to ethical problems caused by manipulating things like scales, dimensions, and symbols when preparing graphs, to visually distort the information being presented.

10. Explain how schematic drawings are used to illustrate and specify electrical and fluid power circuits. Provide students pictorial or physical representations of electrical and/or fluid power circuits. Using traditional or computer-aided drafting tools, have students prepare a schematic for their assigned circuit. Include processes like identifying appropriate symbols for each component and reconfiguring the circuit. Ask students to assess the usefulness of schematic drawings to manufacture, install, and service electrical and fluid power systems.
11. Discuss how maps are a form of drafting and how they are used to communicate geographic features, locations, distances, and routes. Provide each student a problem statement based on a need to get from one location to another or to describe a geographic region (e.g., community, neighborhood, facility). Using traditional or computer-aided drafting/design tools, have students draw maps for their assigned problems. Include processes like using scales, selecting symbols, and/or illustrating topographical features. Ask students to exchange their maps and evaluate their ability to address the assigned problem.
12. Discuss the milestones in the history and evolution of drafting and design technology. Assign each student a historical event. Using library resources, have students gather information and develop an abstract describing the people, dates, places, and impacts associated with their assigned event. Encourage students to illustrate their abstracts. Post each abstract on a large timeline. Ask students to describe how given events influenced our culture and subsequent technological developments.
13. Discuss the career opportunities in drafting and design technology. Include occupations at the non-skilled, semi-skilled, skilled, technician, and professional levels in the discussion. Using library and guidance resources, have students gather information and present a short written or verbal report about an occupation related to design and drafting technology. Each report should include information about the educational requirements, working conditions, benefits, salary, and advancement potential related to the occupation. Ask students to evaluate the career based on their interests, talents, and career expectations.



INTRODUCTION TO DRAFTING AND DESIGN

Introduction

WHAT IS DRAFTING

Imagine what it would be like to build a model from a kit without pictures. You would get a plain white box filled with a hundred plastic pieces and several pages of instructions. It would be very difficult to glue part A to part B when you do not even know what they look like. How can you make a model when you don't even know what the final project will look like? Drafting is important in situations like this. When you need to tell someone how to do something or build something, words are often not enough. As the saying goes, "a picture is worth a thousand words." Most of us appreciate pictures when we want to build or do something technical.

People in industry need an accurate and economical way to communicate complicated and technical information. Drafting is often called the "language of industry." Drafting enables people to communicate through pictures, symbols, numbers, colors, and words. Through drafting, people can record, improve, and explain their ideas.

THE COMMUNICATION PROCESS

Back to wanting to build a model. Imagine the model that you want to make is a rocket. You have never built a rocket before and you want to ask someone with experience for help. You want your rocket to be a certain shape, size, color and more. Your helper will need to understand what you want if he or she is going to be of any help. You need to move the mental picture of the rocket in your mind into the mind of your helper. This process is called communication.

Communication begins with a SENDER. A sender is someone that needs to move information. Unless you like talking to yourself, you will also need a RECEIVER. In our example, the person who will help build the rocket is the receiver.



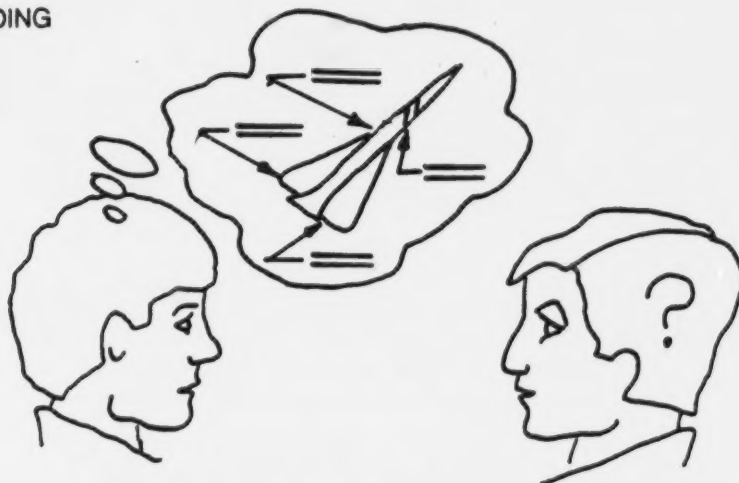
SENDER



RECEIVER

Since the receiver cannot read your mind, you will have to tell and show the receiver what you want the rocket to look like. In order to help the receiver understand what you want, you will need to pick the best combination of words and pictures to help the receiver understand what you want. This process is called **ENCODING**.

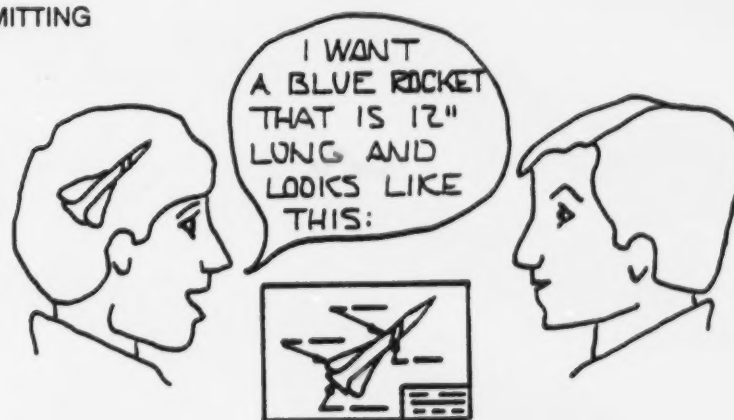
ENCODING



Once you know how to put the information into a form that the receiver can understand, you need to send the message. The process of sending the message is called **TRANSMITTING**. You can transmit information by talking, writing or drawing.

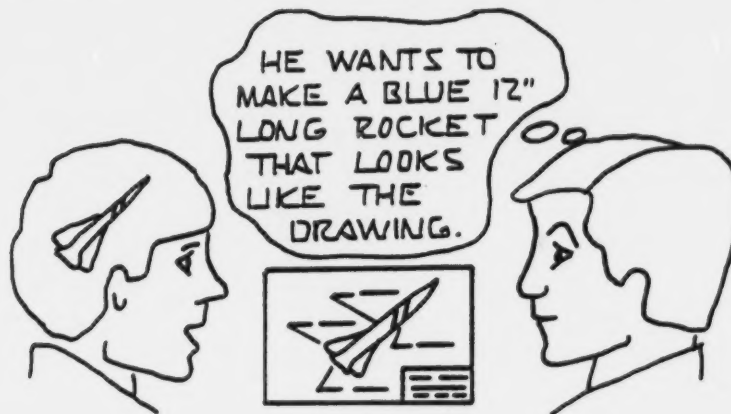
TRANSMITTING

RECEIVING



In order for your helper to understand what you want, he or she must receive the message you transmitted. Your helper must listen to what you are saying and look at your drawing. This is called **RECEIVING** in the communication process.

The next step for the receiver is to create a mental picture in his or her own mind. The process worked, the mental picture in your mind is close to the mental picture in your helper's mind. The goal is for the receiver's mental picture to be the same as the sender's.



During this Technology Education Activity, you will learn how a graphic picture can be used to enhance the communication process.

Materials and Supplies

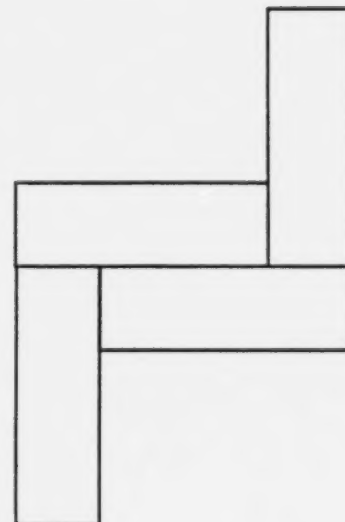
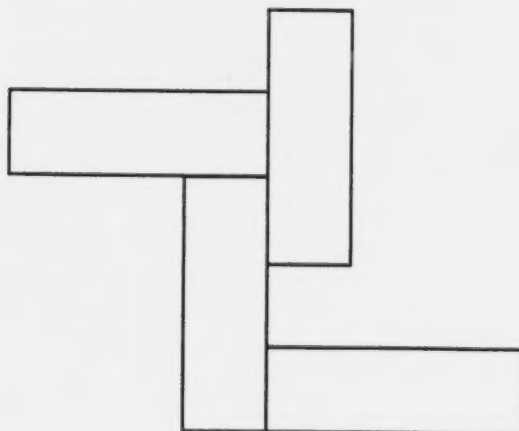
- Paper

Activity Procedures

1. Divide into groups of two. During the first round, one group member will be the sender and the other, the receiver.

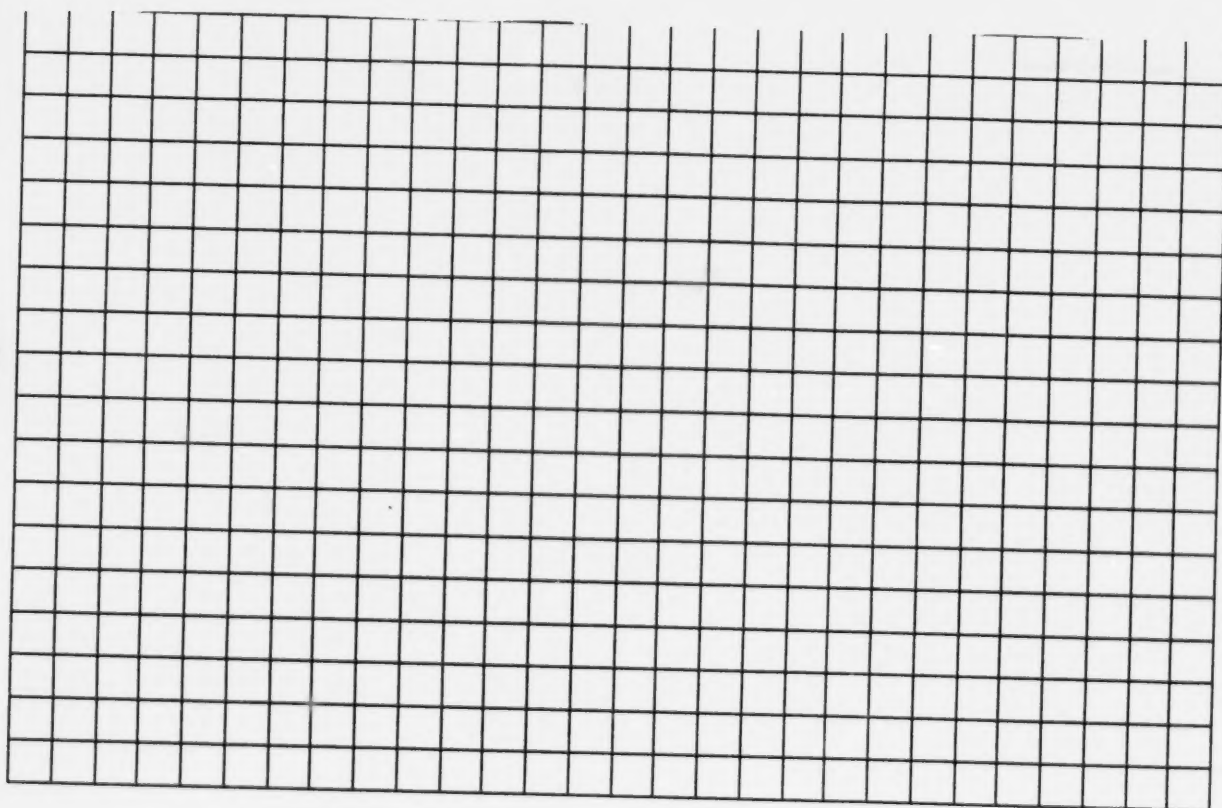
Directions for Round One (SENDER):

2. Do not allow your partner to see the images below. Choose one of the two images for this activity.
3. When your instructor tells you it is time to start, try to describe the image to your partner a little at a time. Remember, your partner will try to draw the image from your description. Hint: give names to positions on the page that you and your partner can use during the communication process (for example: top, right, left, and bottom, or north, south, east, and west).



Directions for Round One (RECEIVER):

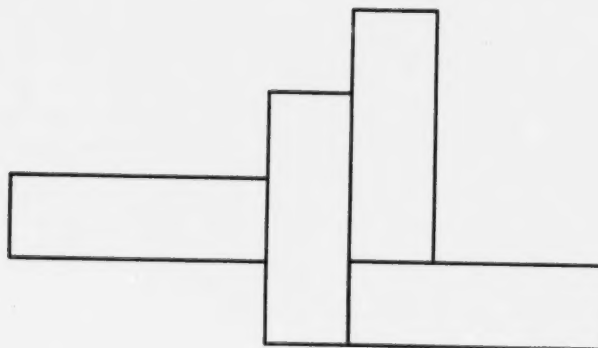
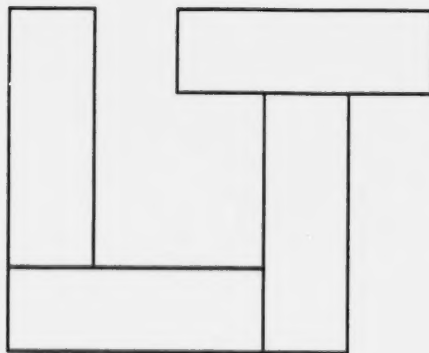
1. Try not to look at your partner's handout; it will spoil the fun.
2. When your instructor tells you it is time to start, your partner will try to describe an image to you a little at a time.
3. Sketch the image in the space below from your partner's description. Hint; give positions on the page names that you and your partner can use during the communication process (for example: top, right, left, and bottom, or north, south, east, and west).



4. On completion of the first round, switch roles with your partner.

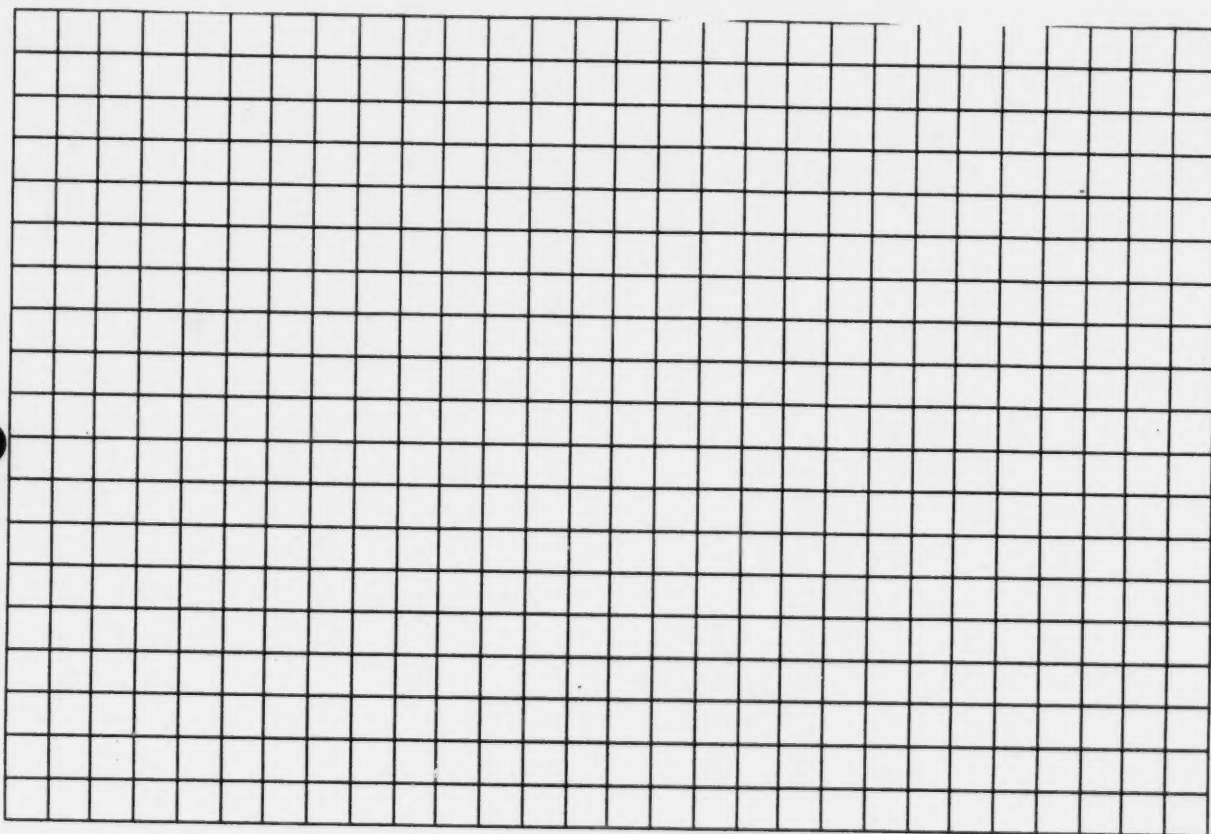
Directions for Round Two (SENDER):

1. Do not allow your partner to see the images below. Choose one of the two images for this activity.
2. When your instructor tells you it is time for round two, try to describe the image to your partner a little at a time. This time, your partner will be trying to draw an image from your description.



Directions for Round Two (RECEIVER):

1. Try not to look at your partner's handout; it will spoil the fun.
2. When your instructor tells you it is time for round two, your partner will describe an image to you a little at a time. It is now your turn to sketch the image from your partner's description in the space below.



Activity Analysis

1. Explain how pictures or drawings can improve the communication process.

2. Based on your experience with this activity, how could you improve the communication process?

3. What would be the impact on industry if they tried to make products based on written and verbal communication only?

SKETCHING A ONE VIEW DRAWING

Introduction

Ideas are often simple sketches on paper long before they get to a drafts person's table or computer. The ability to sketch can enable you to quickly visualize, store, compare, and communicate your ideas. Sketching can help you think clearly, solve problems, and give your ideas to others. Sketching does not require fancy drafting tools, computers or electricity. All you need to help people understand your ideas is a tool to make marks and a surface to record marks (for example: pencil and paper, stick and sand, or chalk board).

THE BASIC RULE FOR SKETCHING:

Learning to sketch is like any other skill, you need to practice. Sketching can be easier to learn and you will be more successful if you follow some simple rules.

1. Sit in a relaxed and upright position.
2. Hold your pencil near the point.
3. Position your paper at a natural angle with your arm.
4. Use arm motions to draw and try to avoid using only your wrist or fingers to draw.
5. Start by lightly sketching the general shape of the object. Save darkening in and drawing details for last.
6. Use single strokes to draw lines, circles, arcs, and irregular lines.
7. Don't be discouraged, sketching well takes practice.

During the Technology Learning Activity, you will learn how sketches can be an effective form of communication.

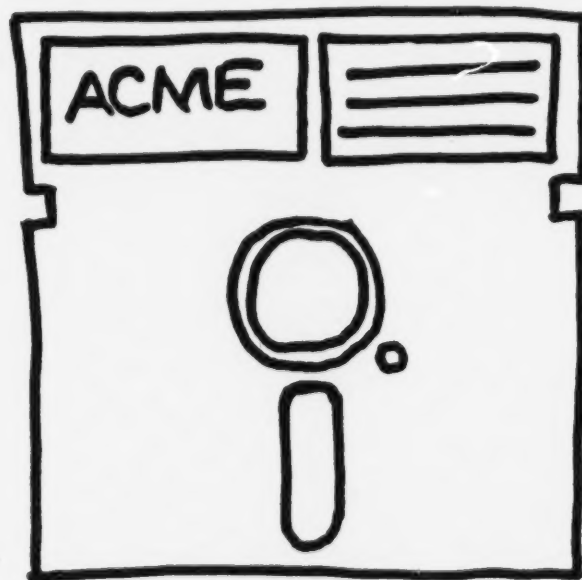
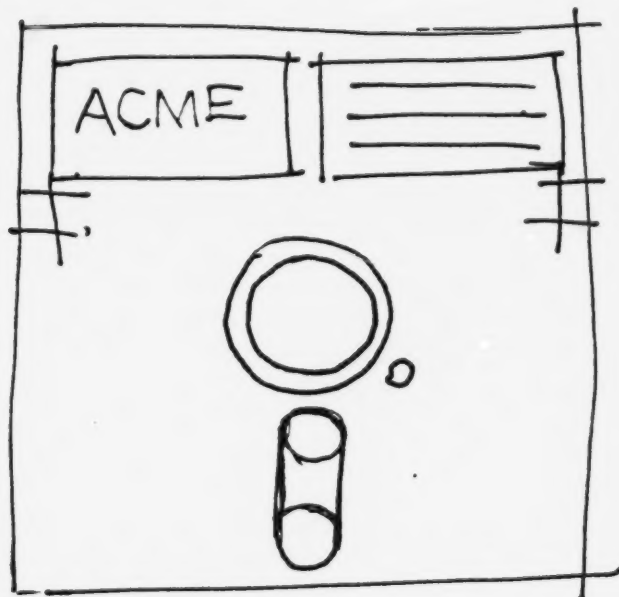
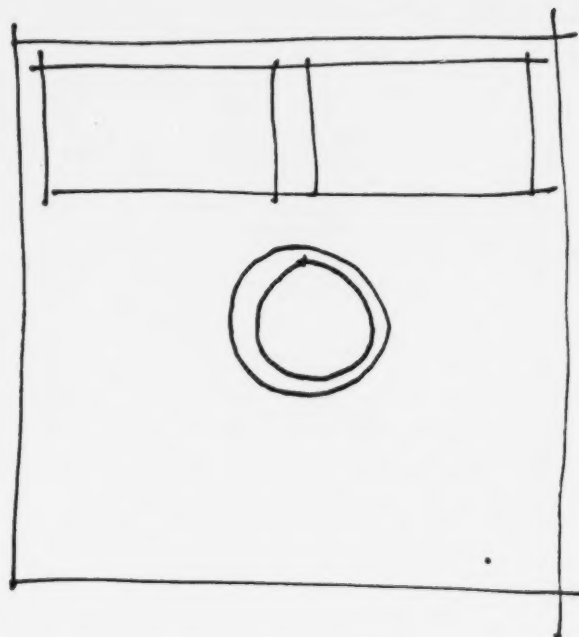
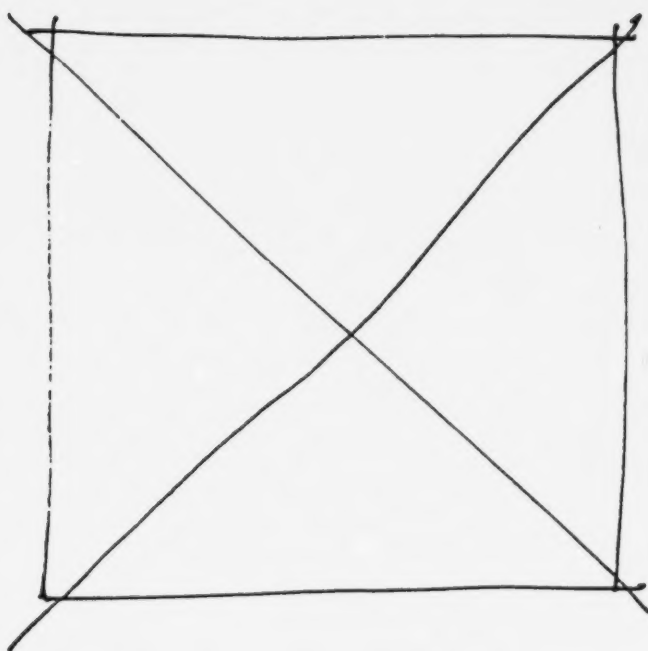
Materials and Supplies

- Pencil
- Eraser
- Plain white paper

Activity Procedures

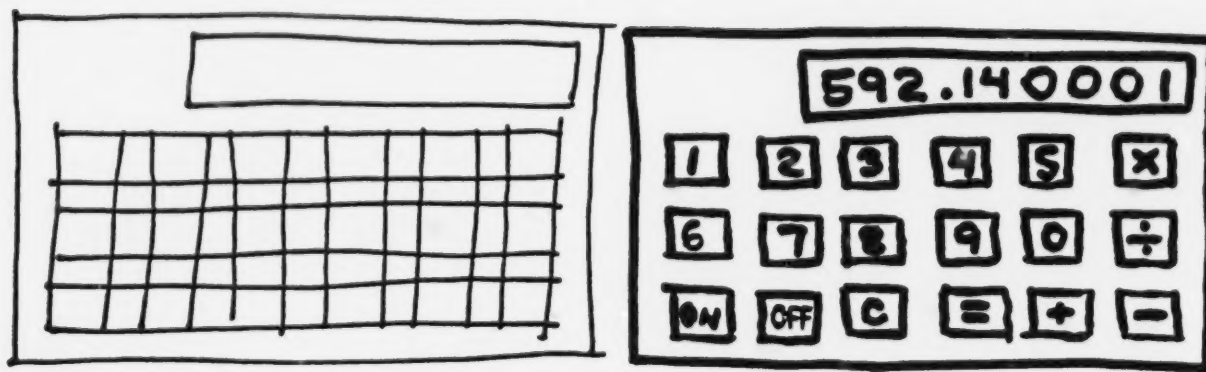
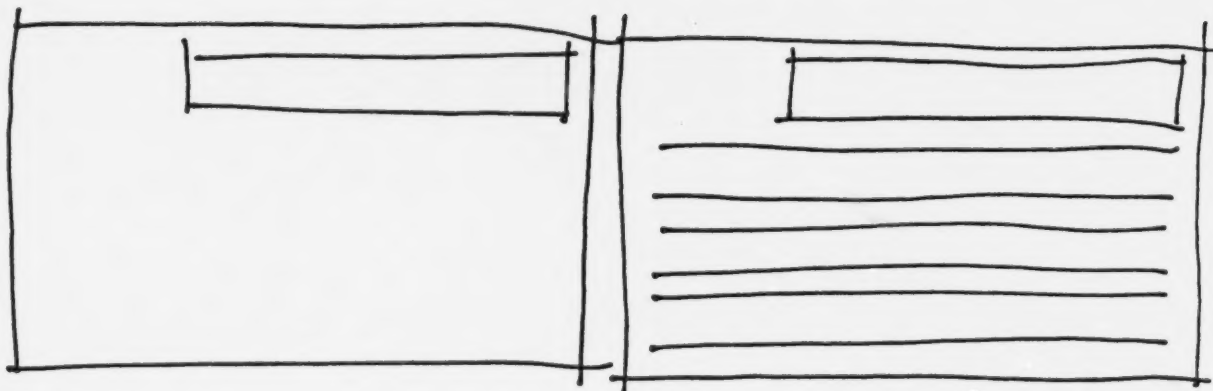
You are to sketch the objects found on DR #1-3 by following the steps illustrated. Remember to use the basic rules for sketching.

DR #1



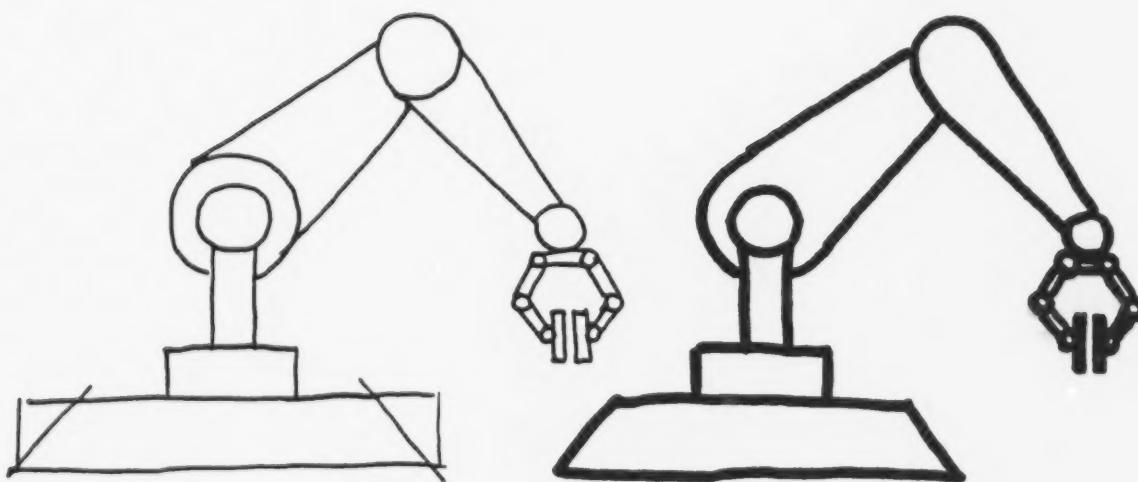
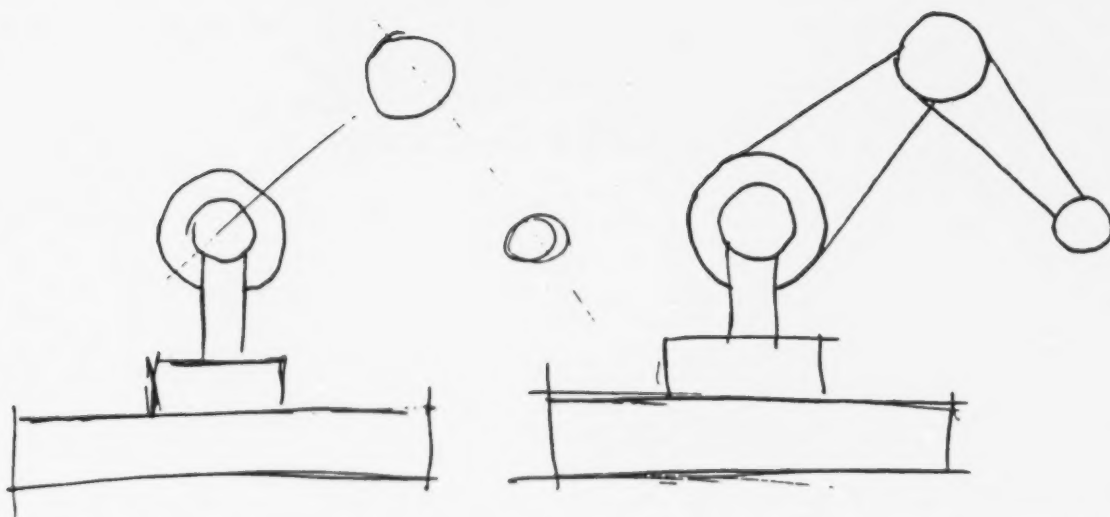
15-D

DR #2



16-D

DR #3



17-D

Activity Analysis

1. Explain why sketching is a valuable communication tool?

2. Identify examples of the two basic resources needed to communicate through sketching?

SKETCHING PICTORIAL DRAWINGS

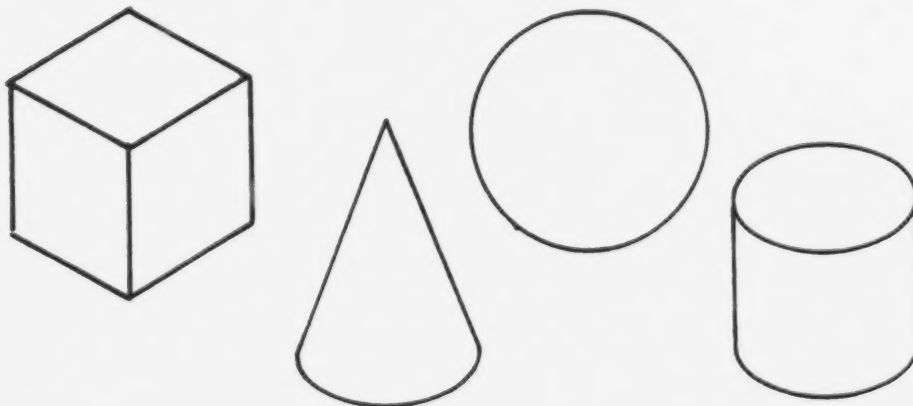
Introduction

As the saying goes, "a picture is worth a thousand words." A pictorial drawing shows two or more sides of the object in one image. Since the object looks real, pictorial drawings are easy for people to understand. In industry, they are powerful communication tools. Pictorial drawings are used when it is important to know how something will look before it is made. Architects use pictorial drawings to show their customers what their houses will look like. Designers use pictorial drawings to communicate their new product design ideas. Managers will look at several drawings before deciding which design idea is the best. Marketing people often use pictorial drawings to advertise and sell products. The people who repair new products often need to refer to pictorial drawings in service manuals. When you purchase a new product that requires assembly, the instructions are often based on pictorial drawings. Unfortunately, pictorial drawings are not very useful when you are trying to communicate a lot of details and measurements. When it is time to make a product, other types of drawings are often used in addition to pictorial drawings.

Activity Procedures

How to Sketch Pictorial Drawings:

Just like the one view drawings, you start with the object's general shape. The general shape of an object can be broken down into one or more of the four basic shapes. These four basic shapes are a cube, cone, circle, and cylinder. By using a combination of these shapes, you can draw the general shape of any object.



Before trying to sketch an object, first study its mass and determine its basic shape or shapes. Sketch the basic shape or shapes on your paper.

After you have laid out an object's basic shape, you can start modifying it to look more like the subject a little at a time. It is important to remember that drawings evolve from rough to refined and from light to dark. Draw the large details first. Try to keep the lines light. Light lines are easier to erase.

Once the large details have been drawn, start adding the smaller details. The last step in the sketch process is to refine your drawing. During this step, you will touch-up your drawing, erase unwanted lines, and darken in the lines you want to emphasize. Once again, don't be discouraged. Being able to sketch well requires lots of practice.

During this Technology Education Activity, you will learn how pictorial drawings are used to communicate information.

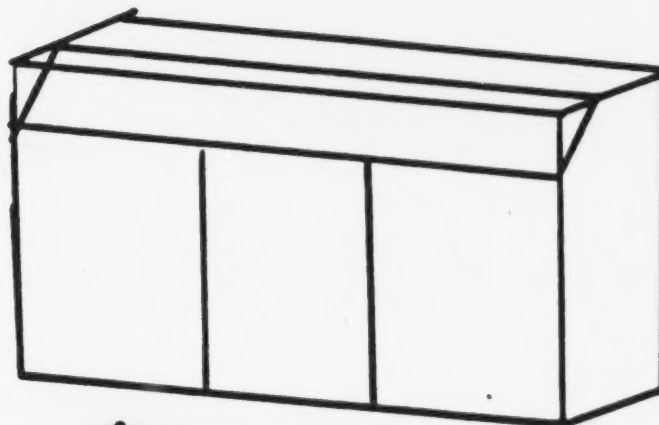
Directions:

You are to sketch the following objects by following the steps illustrated. Remember to use the basic rules for sketching.

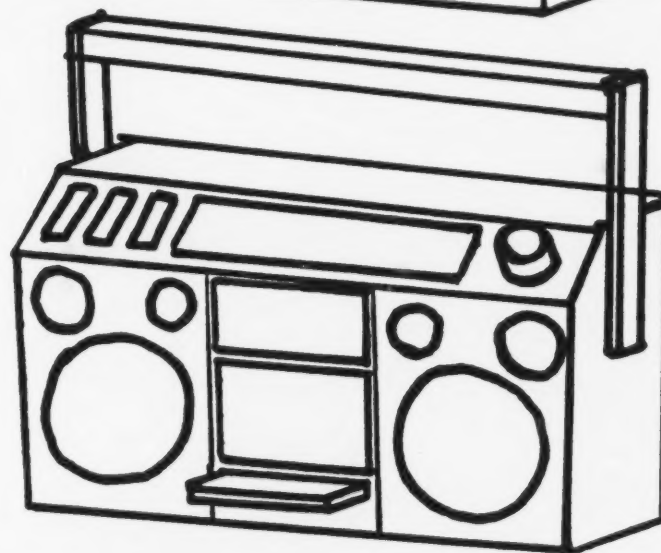
1. Sit in a relaxed and upright position.
2. Hold your pencil near the point.
3. Position your paper at a natural angle with your arm.
4. Use arm motions to draw and try to avoid using only your wrist or fingers to draw.
5. Start by lightly sketching the general shape of the object. Save darkening in and drawing details for last.
6. Use single strokes to draw lines, circles, arcs, and irregular lines.
7. Don't be discouraged, sketching well takes practice.

Materials and Supplies

- Pencil
- Paper
- Eraser

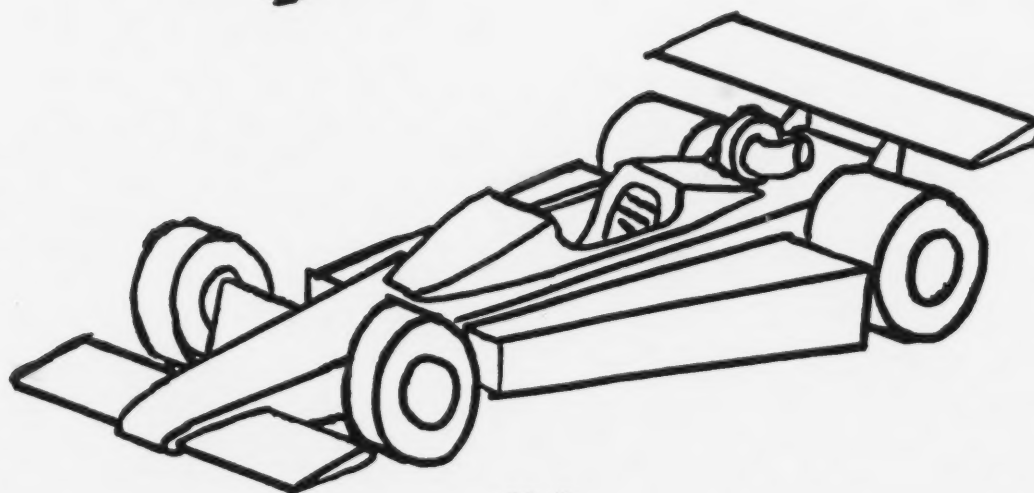
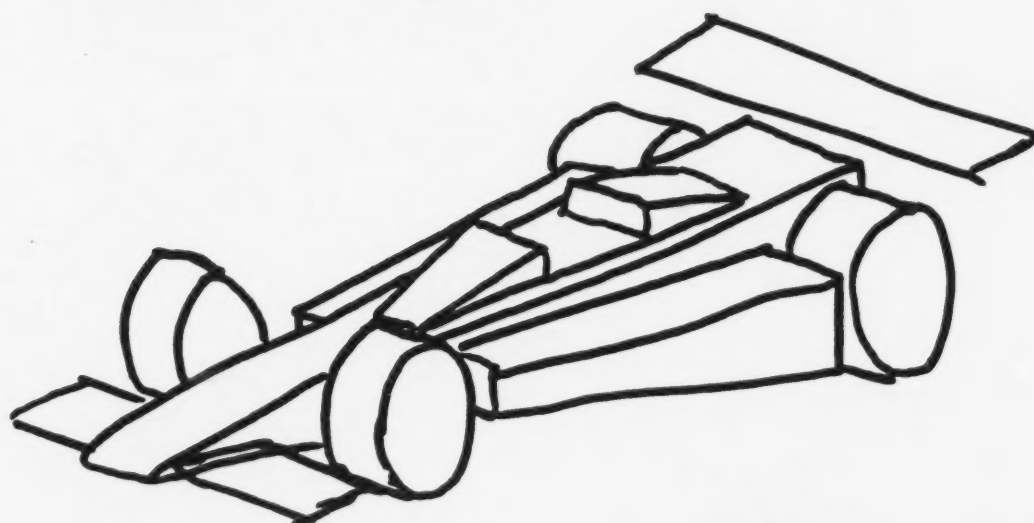
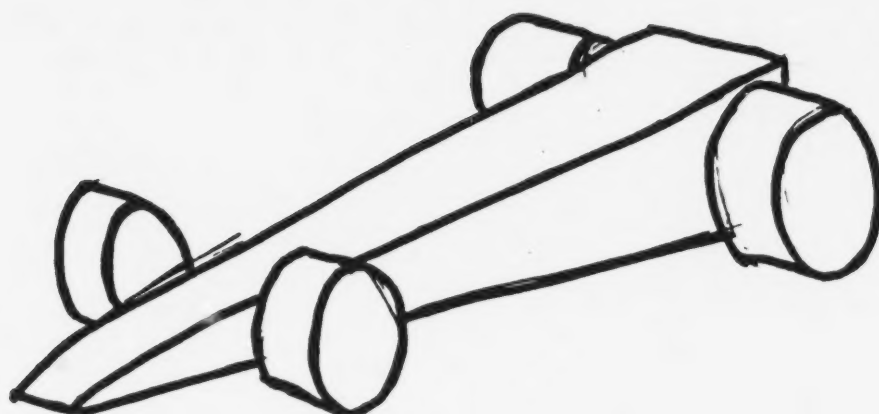


DR #1

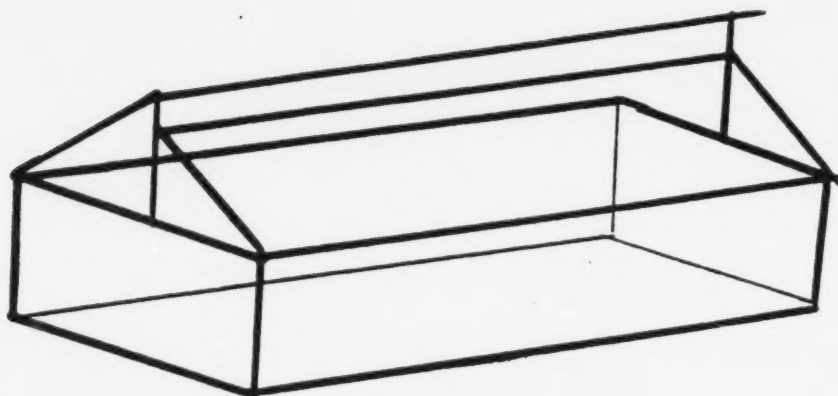


21-D

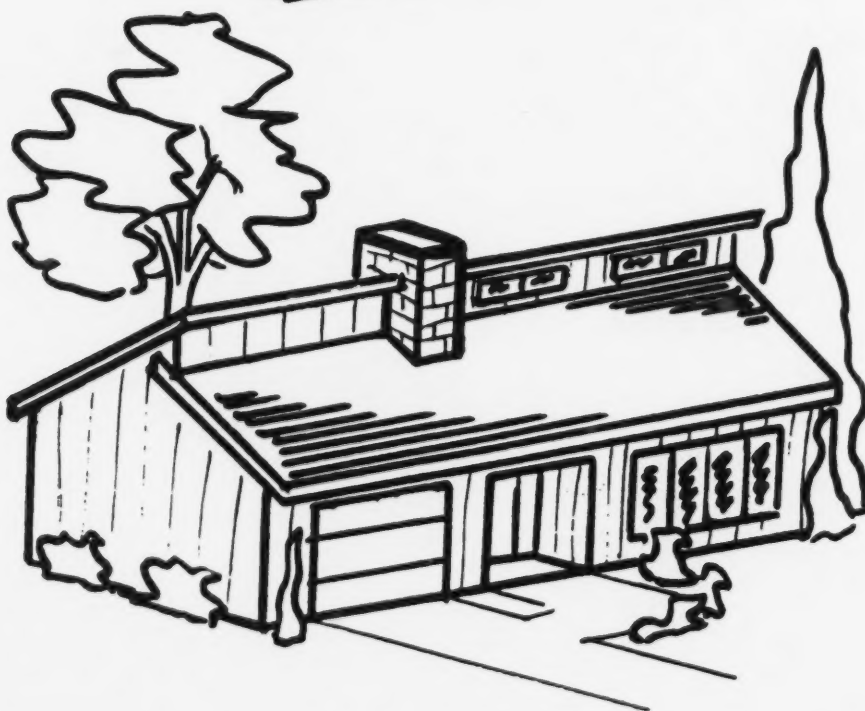
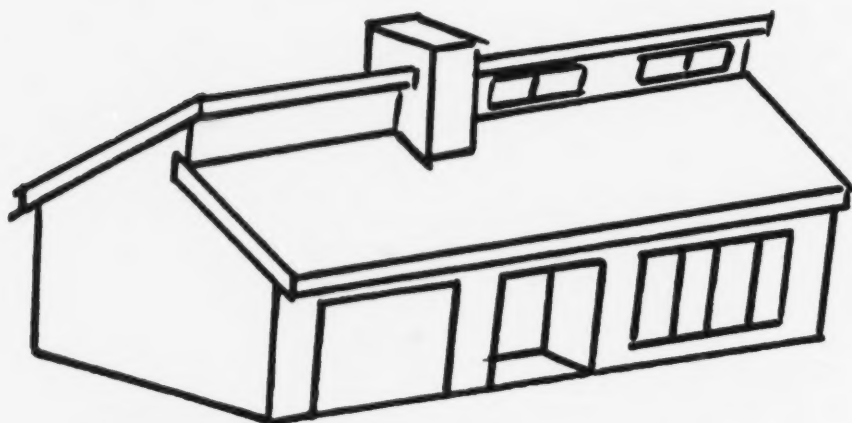
DR #2



22-D

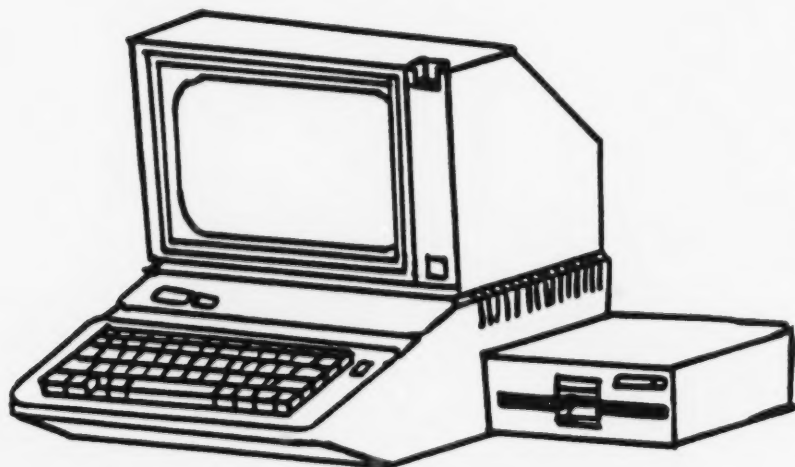
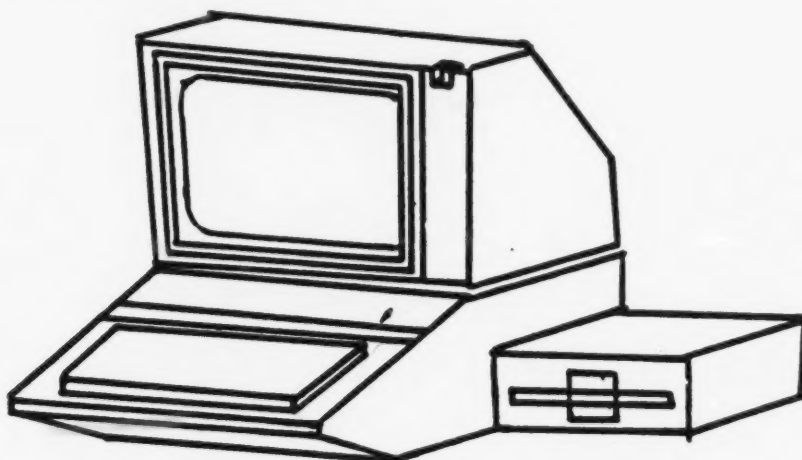
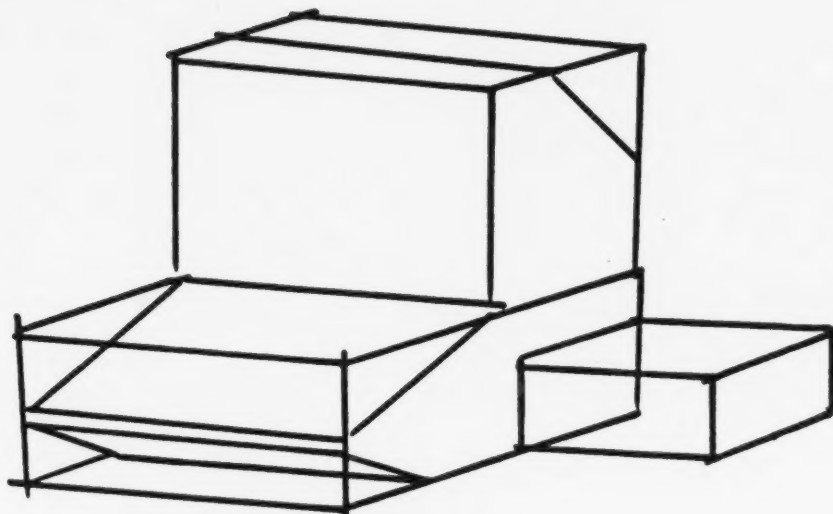


DR #3



23-D

DR #4



24-D

Activity Analysis

1. Explain three places where you have seen pictorial drawings

a. _____

b. _____

c. _____

2. Identify two advantages of a pictorial drawing.

a. _____

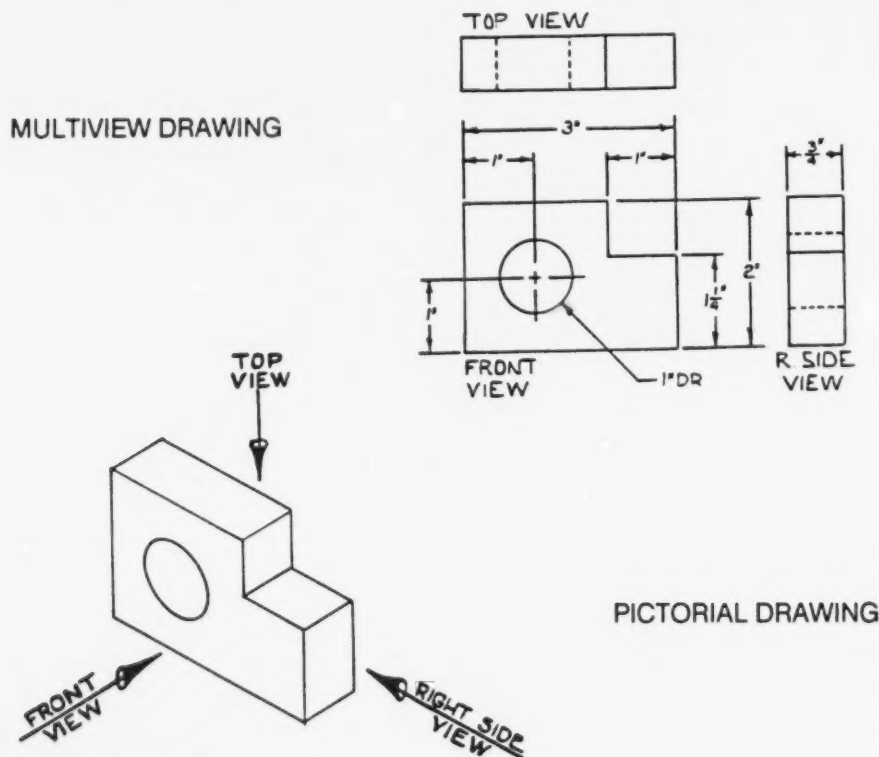
b. _____

3. Identify four basic shapes used to develop pictorial sketches.

SKETCHING MULTIVIEW DRAWING

Introduction

Pictorial drawings can show us how something will look before it is made. However, pictorial drawings are often not very helpful when you need to know how to make something. The size, shape, and details of projects can often be communicated better through what are called "multiview drawings." Each view is like looking at the object from a different direction. Because the objects are shown in several views, there are more places to communicate technical information. The three most common views used are a top view, front view and right side view. The illustration below shows the difference between a pictorial drawing and a multiview drawing.



Materials and Supplies

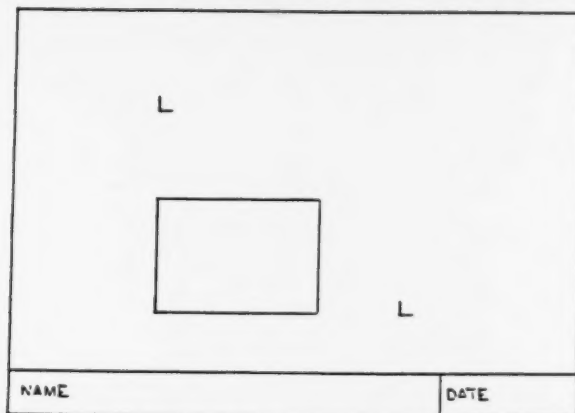
- Pencil
- Eraser
- Widget (samples are shown on DR #1-5). Each widget should be made 3/4" x 3" x 3" stock.

Activity Procedures

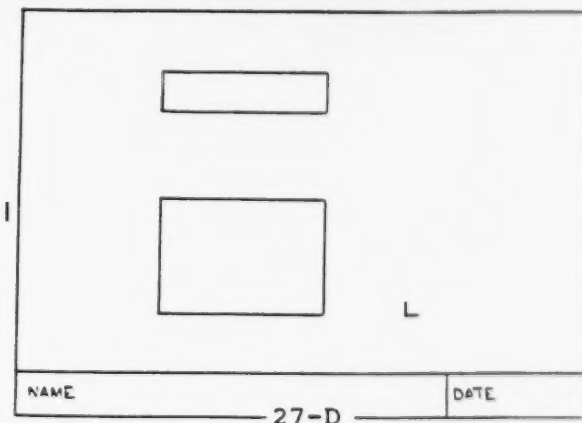
How to Sketch Multiview Drawings:

Before plans are drawn for a new product, designers and engineers usually make several models to see what the product will look like. Using the models as guides, they can draw the plans the production people will use to manufacture the product.

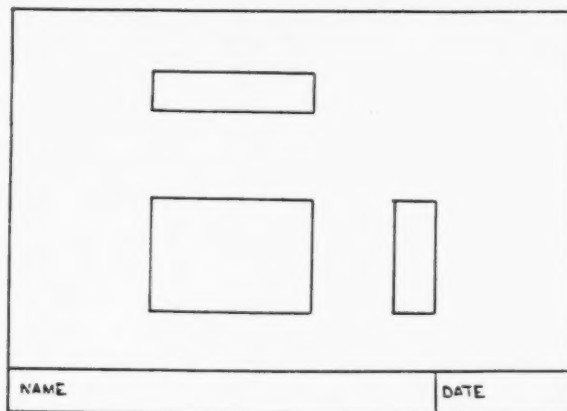
1. Begin by obtaining a model of a widget.
2. Then, using SH #1 and the steps that follow, make a three-view drawing of the widget.
 - a. The first step in making a multiview drawing is to study and draw the model one view at a time. You will need to know what each view looks like and how big it is. Start by holding your model so all you can see is the front view. Just like your earlier drawings, you want to draw the object's basic shape first. The basic shape for your model is a rectangle. Measure how wide and how high the rectangle is in the front view. Draw a rectangle for the front view in its correct location. **Remember, draw lightly first so mistakes are easy to erase.**



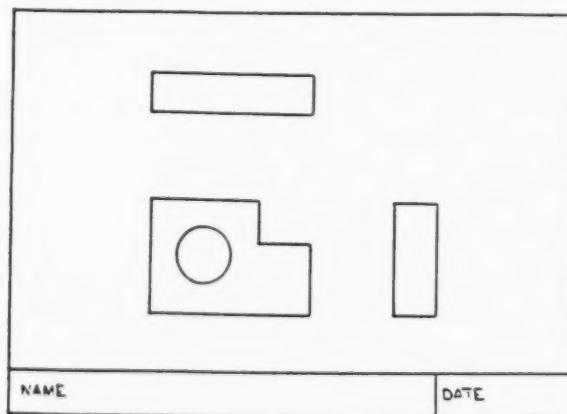
3. Hold your model so all you can see is the top view. The basic shape for the top view is also a rectangle. Measure how wide and how high the rectangle is in the top view. Your object should be as wide in the top view as it is in the front view. Draw the top view rectangle in its location. Use the corner mark provided on your drawing. You can project how wide the top view is from the front view.



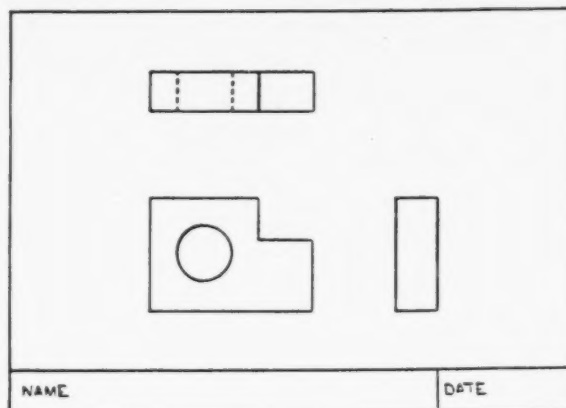
4. Hold your model so all you can see is its right side. Its basic shape is also a rectangle. Measure how high and how deep the rectangle is. The right side should be as high in the right side view as it is in the front view. Draw the right side view in its location and project its height from the front view. You should now have three rectangles on your paper.



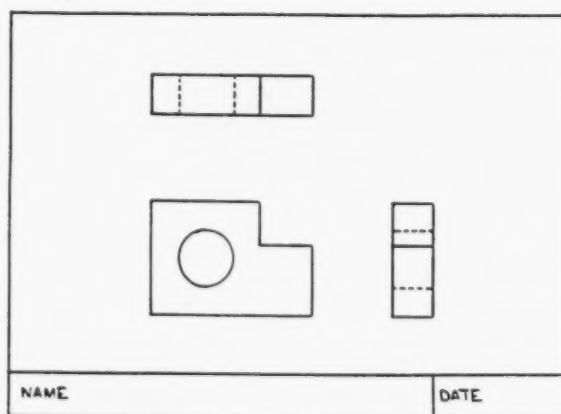
5. The next step in your multiview drawing is to add the features of the object. Study how the features look in the front view first. Measure their size and location and draw them on your front view. Remember to draw each feature with light lines. You may need to erase.



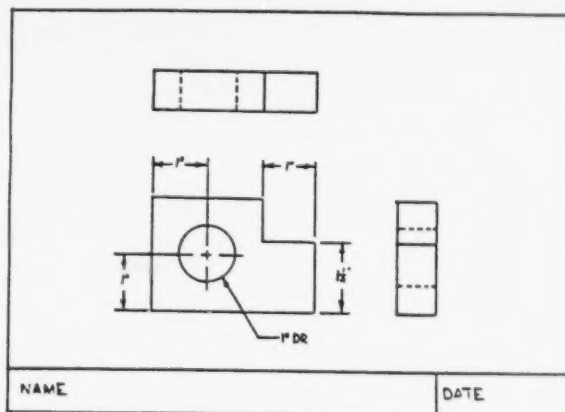
6. Examine the object's features in the top view. You might not be able to see one of the features in the top view even though you know it is there. Even if the feature is hidden from view, you still need to draw it in the top view using hidden lines (lines formed with dashes about 1/8 of an inch long). Use information in the front view to draw the features in the top view.



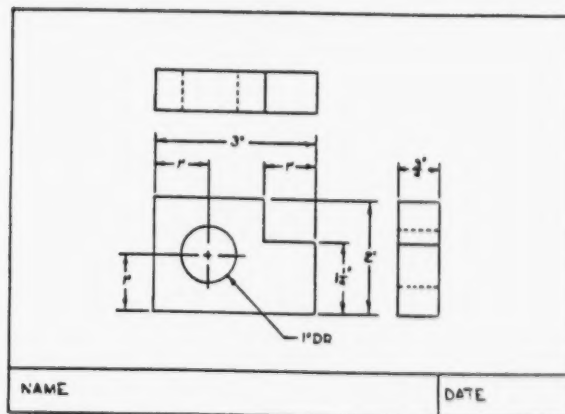
7. Study what the features look like in the right side view. If you cannot see a feature from the right side but you know it is there, draw it using hidden lines. Remember to use information in the front view to draw the features in the right side view.



8. It is time to check your drawing. Place your model so the front view is facing up next to your front view drawing. Look down at both. They should look the same. Where there are edges on your model, there should be lines on your drawing. Make corrections if you need to. Check the top and the right side views the same way.
9. If your object is drawn correctly, it is time to dimension your drawing. When dimensioning, you start with the features. Dimension the features in the view that shows them best. Once the features have been dimensioned, include the overall dimensions. Refer to the example below.



10. Your drawing should communicate the size and shape of your model through three views. Erase the unwanted lines and darken in all the object lines.



11. Put your name and the date in the title block. Make sure your drawing is free of mistakes before you turn it in for a grade.

Activity Analysis

1. What three views are typically found on a multi-view drawing.

- a. _____
- b. _____
- c. _____

2. Identify three types of lines found on multi-view drawings

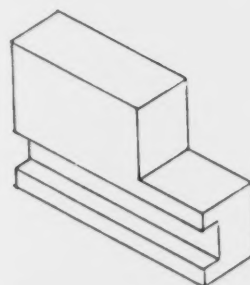
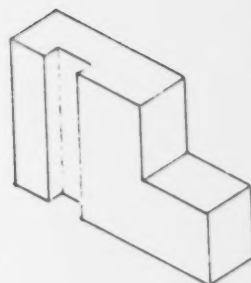
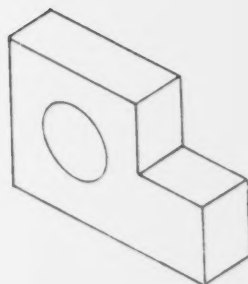
- a. _____
- b. _____
- c. _____

3. Explain what information is typically found on a multi-view drawing.

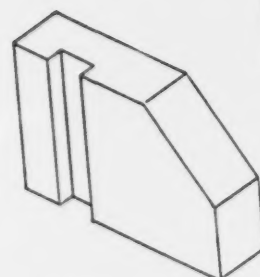
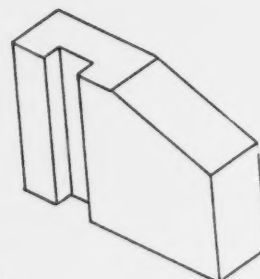
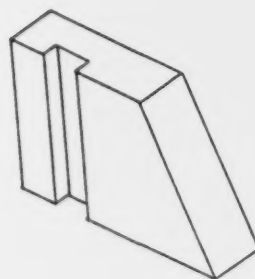
L L L	
NAME	DATE

SH #1

DR #1

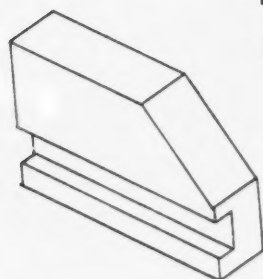
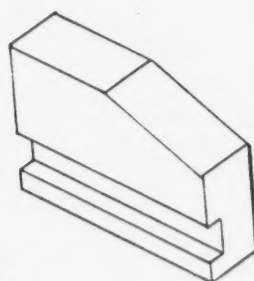
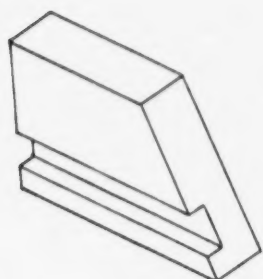


DR #2

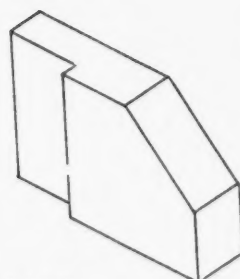
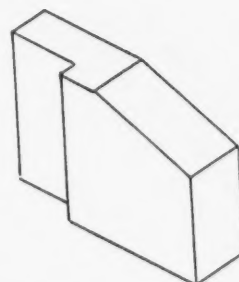
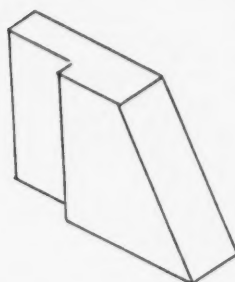


33-D

DR #3



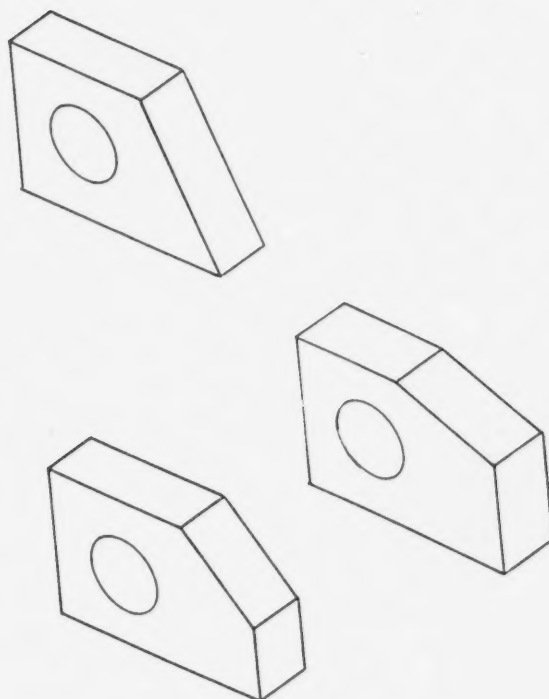
DR #4



34-D

59

DR #5



35-D

61

READING MULTIVIEW DRAWINGS

Introduction

In industry, more people have to be able to read a drawing than are able to make a drawing. After a drafter (sender) has developed a set of drawings for a new product, a variety of people (receivers) will need to read the drawings in order to make the product. Engineers will check the drawings for design errors. Purchasing people will read the drawings to determine the materials or parts that have to be ordered. Production people will read the drawings to organize the people and machines needed to manufacture the product. The quality control staff will have to check the parts produced to make sure they match the drawings. Technical writers will read the drawing to write service and owners manuals for the new product. Lastly, the consumer may have to read drawings in order to assemble or install the new product. Multiview drawings have real value when one knows how to read them.

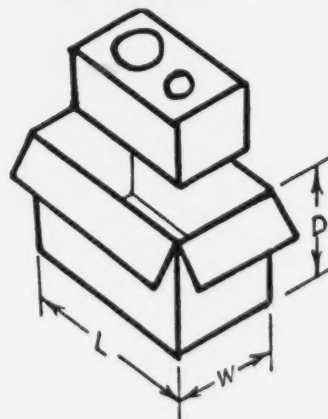
This Technology Education Activity will show you how to read a simple multiview drawing.

Materials and Supplies

- Pencil
- Eraser

Activity Procedures

1. You work in the packaging department and you have been asked to make shipping containers for the company's new speaker. The shipping containers need to be two inches larger than the speaker (width, length and depth [see illustration below]) to allow for styrofoam packing materials, which will protect the speakers during shipping. Use SH #1 to determine the dimensions of the shipping container.



Drawing A

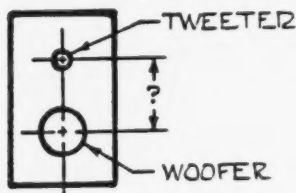
Length = _____ inches

Width = _____ inches

Depth = _____ inches

2. You have been transferred to the engineering department. The head engineer decides that the tweeter (small speaker) is too close to the woofer (big speaker) on the new model (see illustration below). If the woofer and tweeter are closer than eight inches, the speaker cabinet will have to be redesigned. Using SH #1, determine the distance between the tweeter and the woofer.

The distance between the woofer and tweeter is _____ inches.



3. You have been transferred again. This time you are in the purchasing department. The manager wants to call her suppliers and order the materials for the new speaker cabinet. She wants to know what size woofers and tweeters to order for the new model. In addition, she wants to know what kind of material and fasteners will be used to make the new speaker cabinet. Using SH #1, determine the information needed.

Tweeter size = _____ inches

Woofer size = _____ inches

Cabinet material is _____ inch _____.

The fastening materials needed are _____ and _____.

4. Guess what? You now work for the production department. The shop foreman wants you to set up the router to machine the joints for the top, bottom and sides. In order to choose the right cutting tool, you need to know what kind of joint is being used. Using SH #1, determine which of the following joints are being used.

_____ butt joints

_____ dado joints

_____ miter joints

_____ rabbet joints

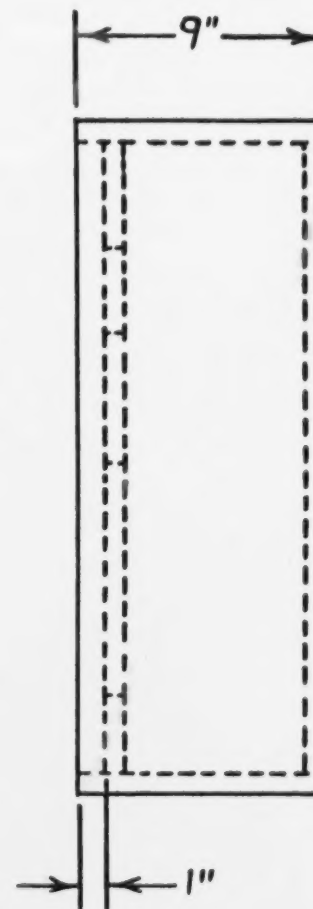
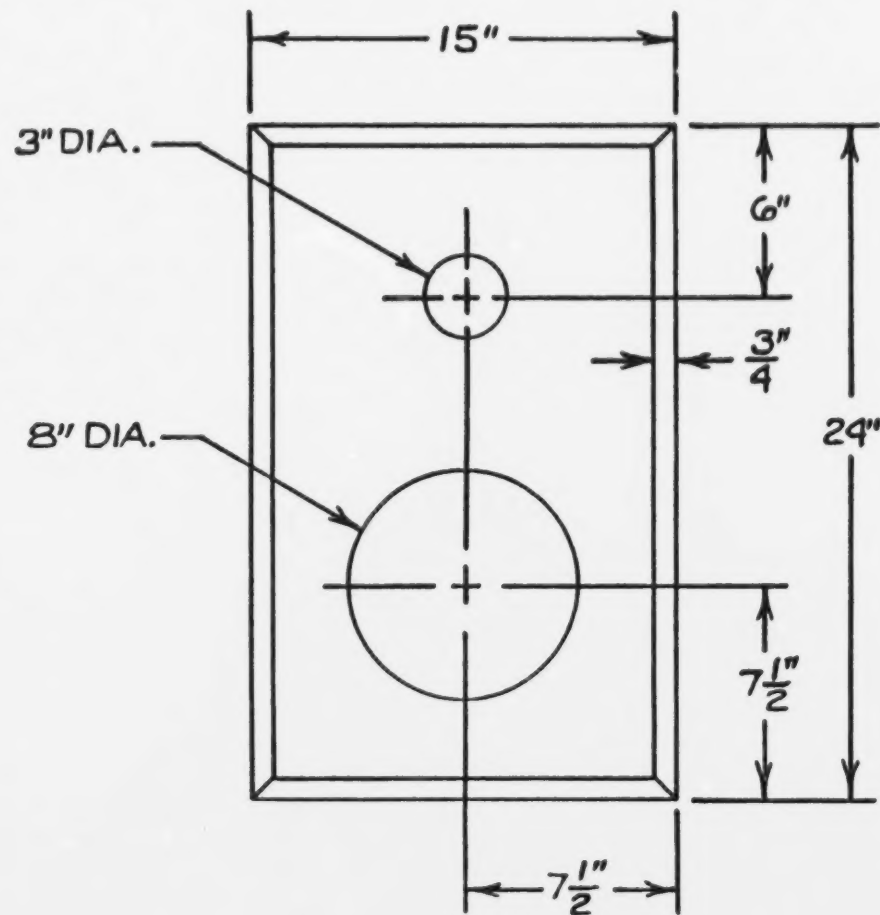
5. The materials needed to make the speaker cabinets come in large sheets. The cabinet parts will need to be cut out of the sheets with as little waste as possible. The machine operators need to know the sizes and number of parts required to make each cabinet. A list of parts and their sizes is called a bill of materials. Read the drawing and develop a bill of materials for one speaker cabinet.

BILL OF MATERIALS

PART NAME	SIZE	QUANTITY
	THICKNESS x WIDTH x LENGTH	

Activity Analysis

1. List three careers or jobs where people need to be able to read and understand drawings.



NOTES:

1. MITER TOP, BOTTOM, AND SIDES
2. FASTEN ALL JOINTS WITH WHITE GLUE AND 4D FINISHING NAILS

MATERIAL:
3/4" PARTICLE BOARD

SCALE:
1/2" = 3"

NAME: JIM SMITH

TWO-WAY SPEAKER
ENCLOSURE

DATE: 4-20-86

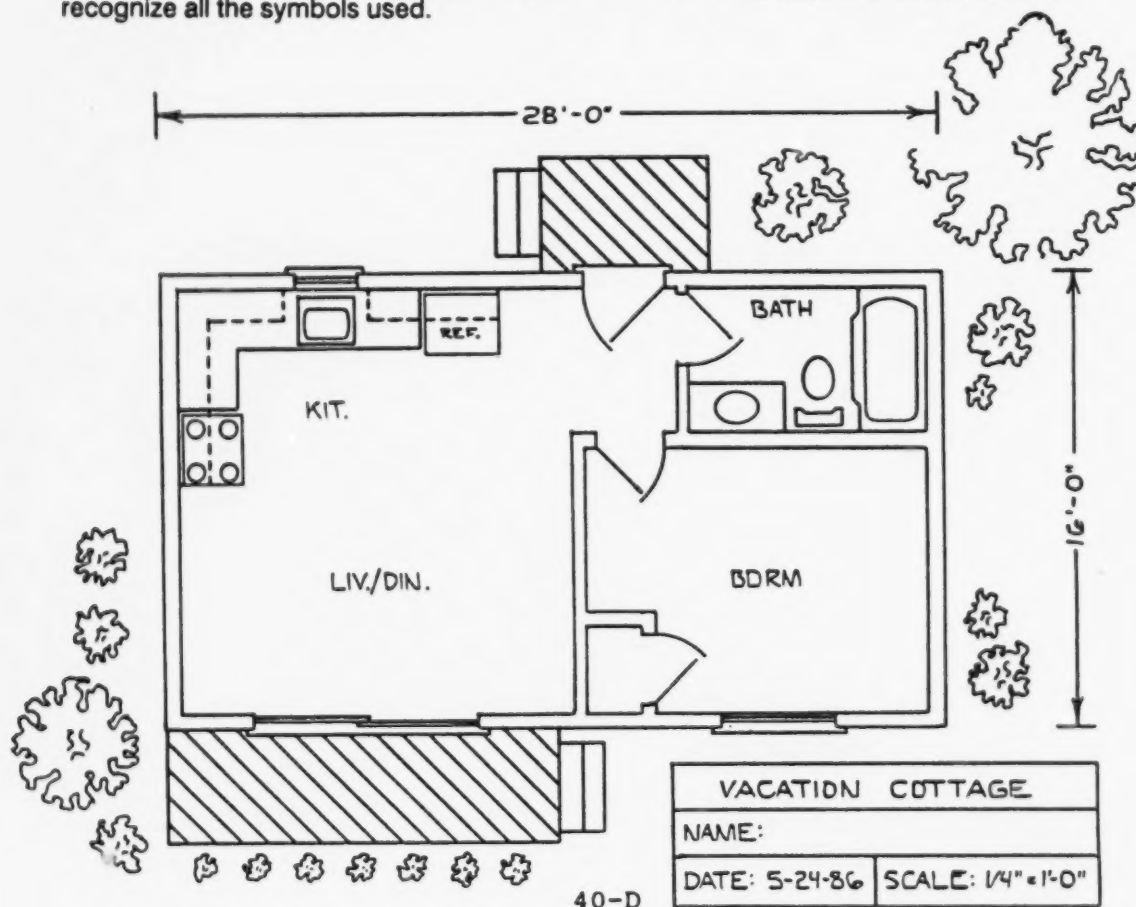
DEVELOPING AN ARCHITECTURAL FLOOR PLAN

Introduction

Houses, apartments, office buildings, factories, shopping malls, schools, and even recreational vehicles started out as ideas in someone's mind. When ideas about buildings are drawn on paper they are called architectural drawings. Architectural drawings are very important communication tools when designing, building, selling, and servicing buildings.

The most commonly used type of architectural drawing is called a floor plan. Floor plans are a form of cut-away drawing. They show what a building would look like if you cut the top off and looked down from above. Floor plans can provide more information about a building than any other type of architectural drawing. They show locations for rooms, windows, doors, cabinets, bathroom fixtures, storage, fireplaces, and much more.

Floor plans would be impossible to draw without symbols. Simple easy-to-draw and understand symbols are used to represent things like doors, windows, bathroom fixtures, appliances and more. Look at the floor plan on the following page and see if you can recognize all the symbols used.



In order for a building to be functional, it must meet the needs of the user. To meet the needs of the user, houses have three basic areas. These areas are the sleeping area, working area, and living area. The sleeping area includes bedrooms, bathrooms, and closets. The work area includes the kitchen, laundry room, and the garage. The living area is made up of the living room, family room and the dining room. These areas are organized on the floor plan so people can move freely inside the house, enjoy outside views, and have privacy.

Architects often use templates to develop a floor plan. Each template represents a room. The rooms are arranged into areas by moving the templates around until a good combination is developed. Once the areas have been laid out, they are arranged into a building. Using movable templates allows the architect to explore a lot of floor plan options very quickly. After a good floor plan has been developed, a very detailed set of plans can be drawn.

Problem Statement

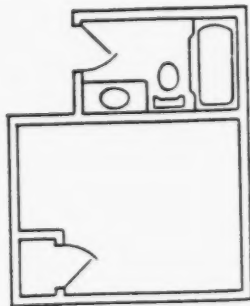
You are working for an architectural firm as a draftsman. One of the firm's customers wants to build a vacation cottage but he/she is not sure what it is to look like. The cottage is to have a kitchen, one bath, and one bedroom with at least one closet. The cottage only needs to accommodate two people so it does not need to be very big. Your job is to develop a possible floor plan for the customer to look at and evaluate. Develop the floor plan using a piece of graph paper and the templates provided (SH #1).

Materials and Supplies

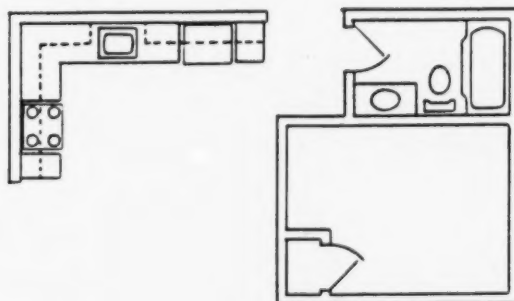
- 11" x 17" piece of graph paper
- scissors
- rubber cement
- template (SH #1-4) Multiple copies may be required of some sheets.

Activity Procedures

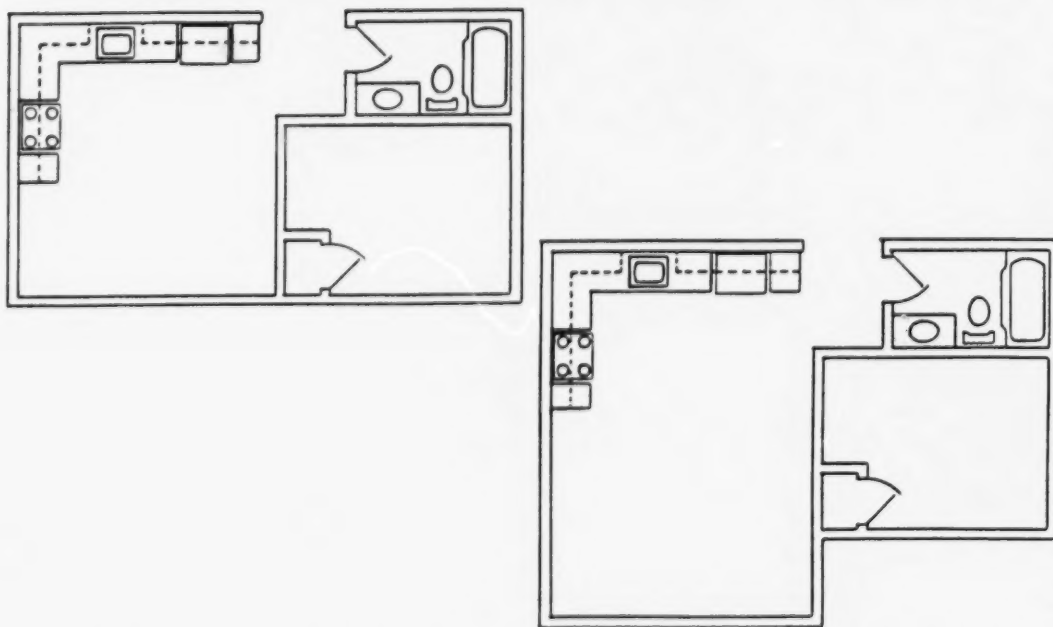
1. The first step in developing your floor plan will be to lay out the sleeping area (bedroom, bathroom and closet). Choose and cut out the templates you want to use and locate them on your graph paper. You may want to move them around until you have found the arrangement you like best. **Do not glue them down; you may want to change them later.** Do not worry about adding windows and doors yet. See the illustration below for an example.



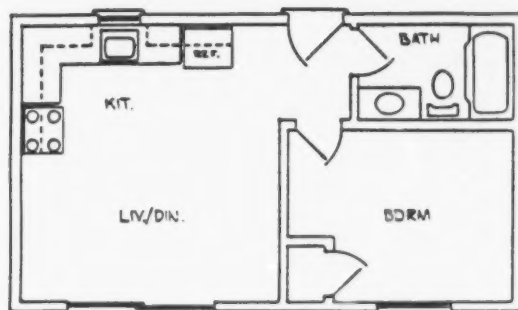
2. For the next step you need to locate the working area. Choose and cut out the kitchen style you like best. Locate it on the graph paper. Try several locations. Make sure the kitchen does not interfere with the bathroom or the bedroom. The kitchen does not need to touch the other rooms. Do not glue yet. For an example of a kitchen location, see the illustration below.



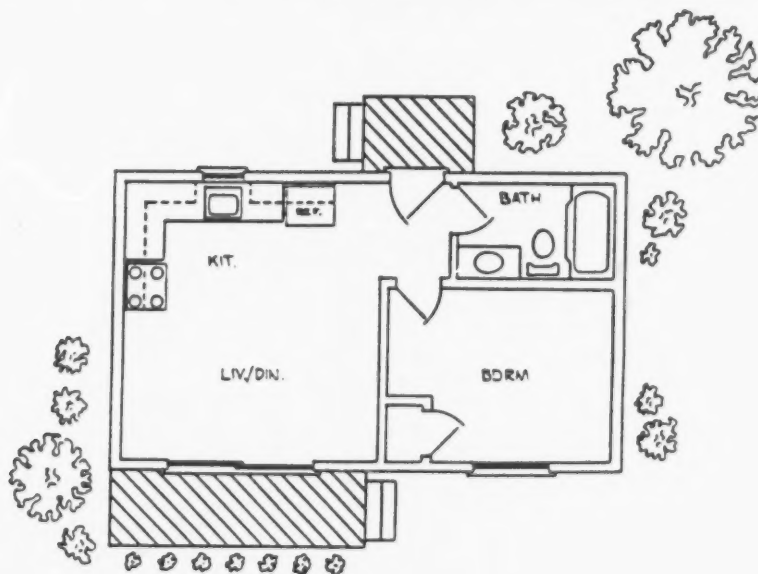
3. Now it is time to think about the living area. Since we are developing a floor plan for a vacation cottage, a formal living room and dining rooms with walls are not appropriate. Simply draw an outline on your graph paper where you would like the living area to be. Remember, your cottage does not need to be a perfect rectangle. Your cottage can be "L" shaped if you want. Refer to the following two floor plans.



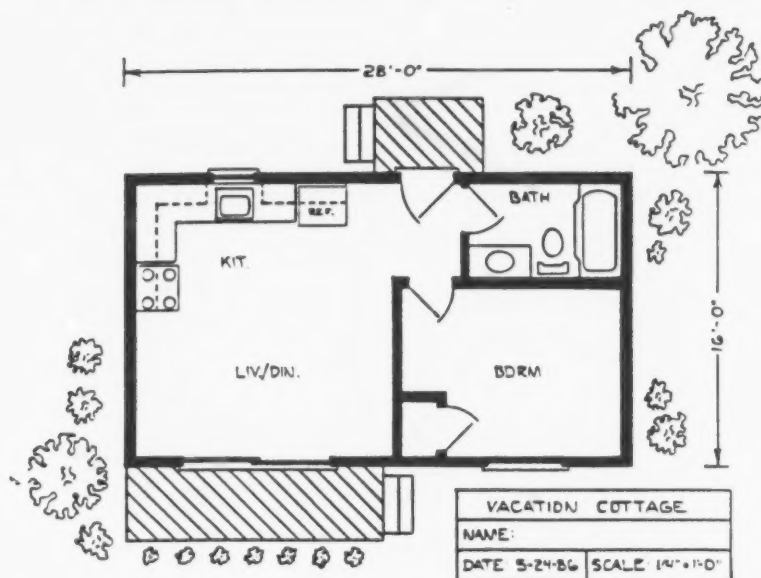
4. If you are satisfied with the positions of your templates, you can glue them down.
5. It is time to connect the walls, locate windows and locate doors. You can either cut window and door templates out and glue them on your graph paper or draw the symbols on your graph paper. Your cottage must have two exits and the bedroom must have two means of egress (a way out in case of a fire). Your two means of egress can be either two doors or a door and a window. See the illustration below.



6. Vacation houses are built several feet above the ground. Therefore, each exit will need a deck with stairs. Choose and cut out the deck templates you want to use and glue them on your floor plan. While you are at it, why not landscape the yard? Locate trees (the large symbols) and bushes (the smaller symbols) so they do not interfere with the view from windows and doors. You can either use the templates provided or sketch the landscaping symbols on your floor plan. See the floor plan below.



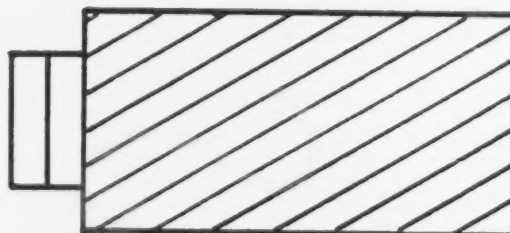
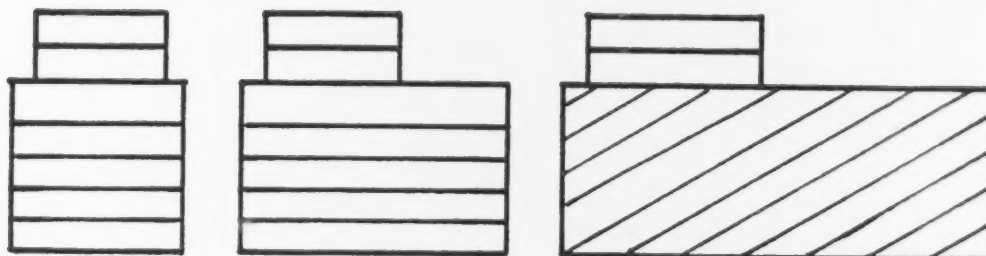
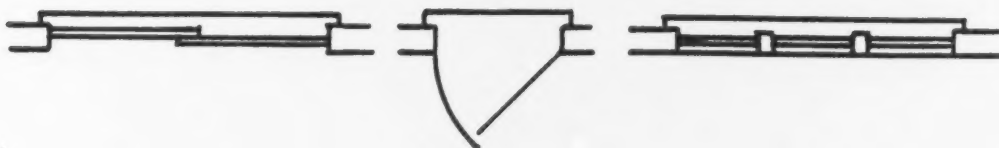
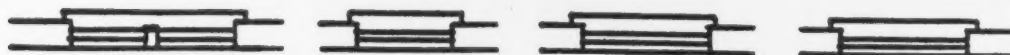
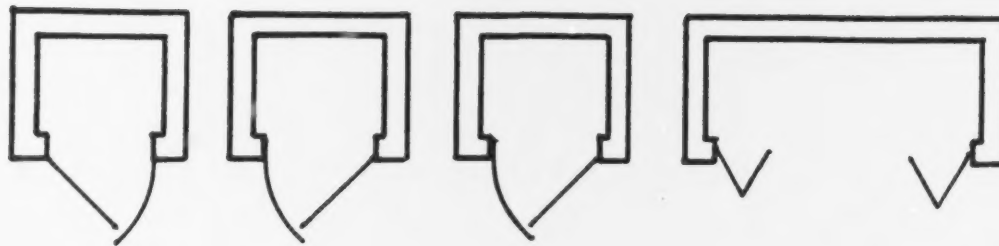
7. All your floor plan should need now is darkening in, documentation and dimensioning. Darken in the walls so they are all connected. Do not darken the windows and doors. Next, label all the rooms. Lastly, measure the length and width of your vacation cottage. Every $\frac{1}{4}$ " equals one foot. Label your dimensions in feet and inches (for example: 24' 0"). Refer to the illustration below.



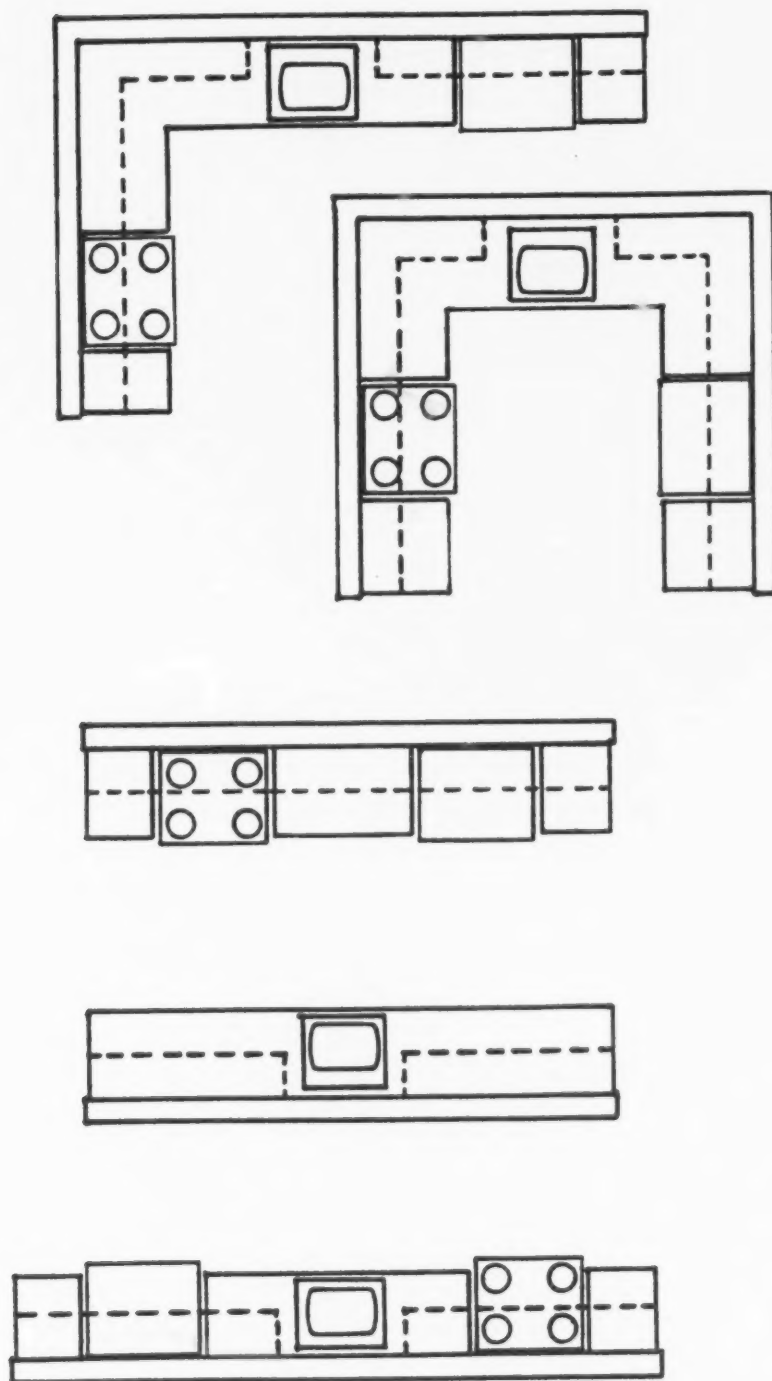
8. Draw a title block on your floor plan and write your name and the date in it. Make sure your drawing is free of mistakes before you turn it in for a grade.

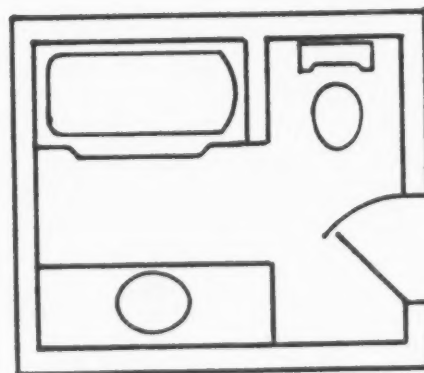
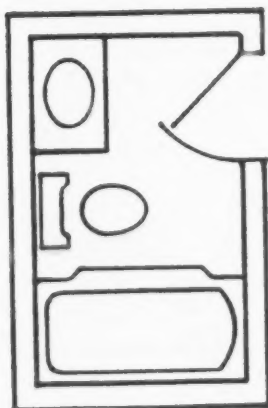
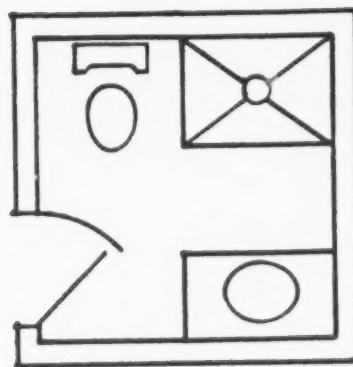
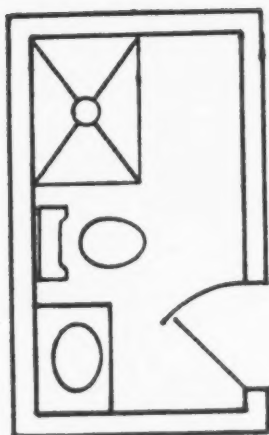
Activity Analysis

1. Identify five items that can be found on a typical floor plan.
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____
2. Sketch the correct floor plan symbol next to each of the following
 - a. bathroom door
 - b. window
 - c. range
 - d. toilet
3. List the three basic areas on a floor plan.
 - a. _____
 - b. _____
 - c. _____

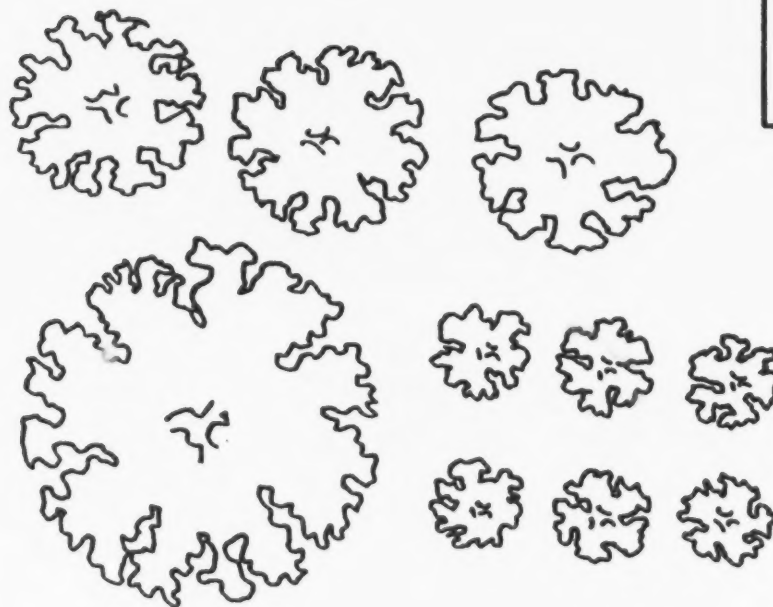
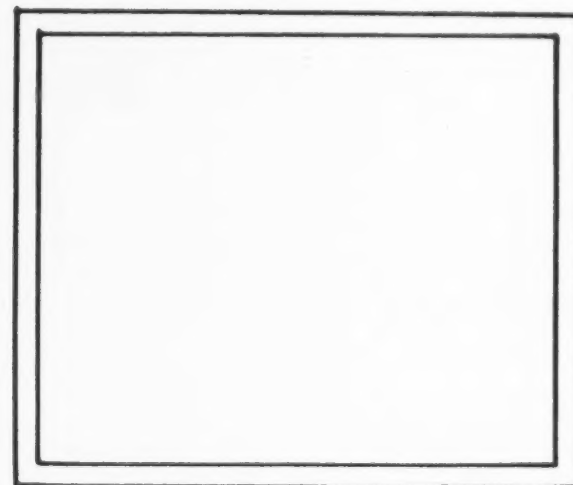
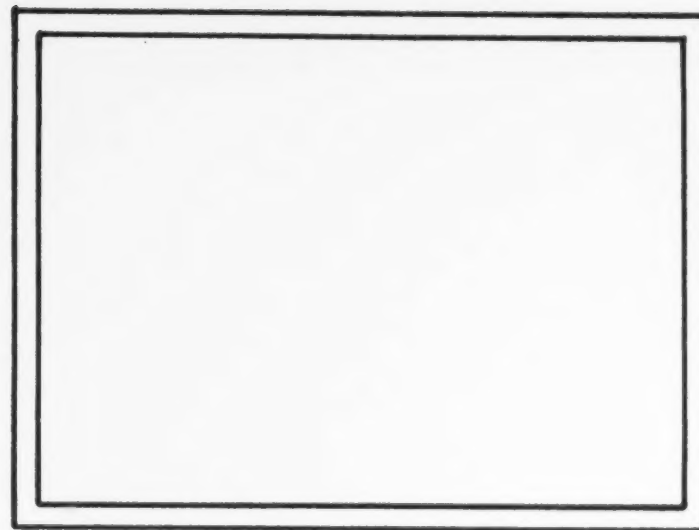


NAME:	DATE:
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VACATION COTTAGE
NAME:
DATE:



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READING AN ARCHITECTURAL DRAWING

Introduction

In the construction industry, there are many people who need to be able to read architectural drawings. Architectural drawings are such an important form of communication between architects, builders and their customers that they are considered legal documents. If there is a conflict between an architect, builder and a consumer, the drawings can be used in court to settle the dispute.

A floor plan is the most important drawing to be able to read. Designers use floor plans to present their ideas to the customer. The customer needs to be able to read the drawings and determine if the proposed building will meet their needs. A building inspector will read the floor plan to make sure the project follows local building codes (rules for building structures). If the design meets code, the inspector will issue a permit so the building can be built.

The builders will use the floor plan to estimate the cost of the project and order the materials needed for the project. When building begins, carpenters will use the floor plans to locate walls, windows and doors. Electricians will use them to locate electrical receptacles, lights, and switches. Plumbers use them to locate pipes and fixtures. The heating and air conditioning contractors use floor plans as a guide when sizing and installing climate control systems.

Remodeling projects, like building kitchens and room additions, often require floor plans for use during the planning and building processes. Floor plans are also often used by people in the service industry who install things like burglar alarms, smoke detectors, and sprinkler systems. Sales people use floor plans to communicate the features of their product. Their product could be a vacation home, camper, or mobile home. When you are looking for a specific store in a shopping mall, the directories are often in the form of floor plans.

Floor plans are commonly used communication tools. If you know how to read them, they can help you understand other people's ideas. In addition, if others can read your drawings, you can help them understand your ideas.

During this Technology Education Activity, you will learn how to read a sample floor plan.

Materials and Supplies

- Pencil
- Eraser

Activity Procedure

1. You are working for a company that builds vacation homes. One of your customers found a floor plan in a magazine (SH #1) and wants a rough idea of what it will cost to build. The first step in making a rough estimate is to determine the area of the building in square feet. Use the dimensions on the floor plan to figure the area. To figure the area, multiply the building's length by its width.

Length (feet) X Width (feet) = Area (square feet)

_____ X _____ = _____

The next step is to multiply the number of square feet by the cost per square feet. For our estimation, it will cost about 50 dollars per square feet to build the vacation house.

Square feet X cost per square foot = Building Cost

_____ sq. ft. X \$50 = \$ _____

It will cost about _____ dollars to build the vacation home.

2. Before you can build the house, you must make sure the plan meets building codes. One of the most important code requirements is that all the major rooms have two means of egress (ways out in case of fire). Using SH #1, list the means of egress for each of the following rooms.

Living and Dining Rooms

1. _____

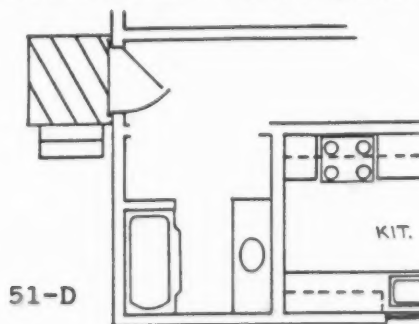
2. _____

Bedroom

1. _____

2. _____

3. Putting plumbing in outside walls can cause trouble in colder climates. It is difficult to insulate the plumbing and prevent it from freezing. Your customer's floor plan shows the water closet on an outside wall. On the plan below, sketch how the bathroom can be redesigned so the water closet is on an inside wall. You will have to relocate the door.



4. Before materials can be ordered, make a list of doors and windows. The lists that go with a floor plan are called "schedules." Using the floor plan as a guide, complete the following schedules (lists).

Door Schedule

Symbol	Type	Size	Quantity
①	EXTERIOR	3'-0" x 6'-8"	
②	INTERIOR	2'-6" x 6'-8"	
③	BIFOLD	4'-0" x 6'-8"	
④	SLIDING GLASS	6'-0" x 6'-8"	

Window Schedule

Symbol	Type	Size	Quantity
Ⓐ	CASEMENT	R.O. = 2'-0" x 3'-0"	
Ⓑ	CASEMENT	R.O. = 4'-0" x 4'-0"	

5. In addition to doors and windows, kitchen appliances and bathroom fixtures need to be ordered. Read the floor plan (SH #1) and check the items that would need to be order off the list below.

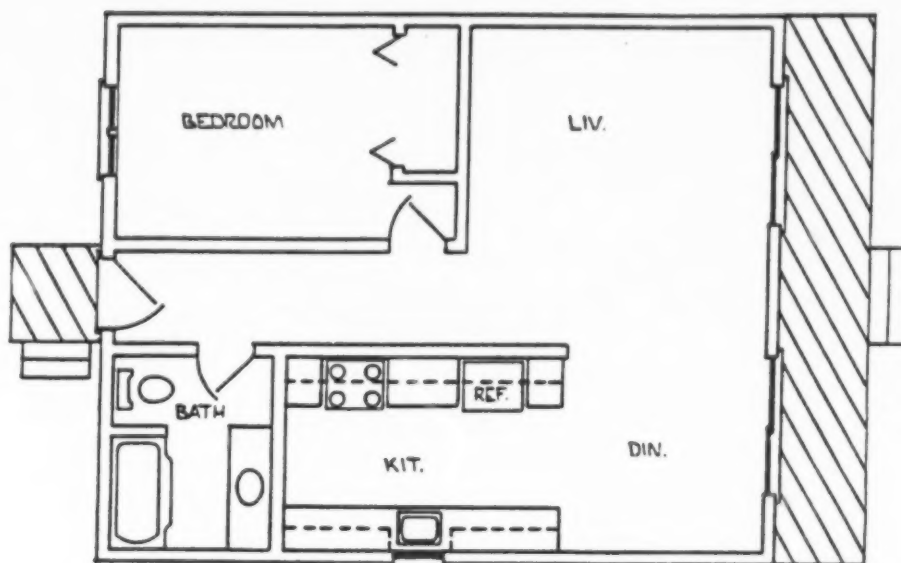
Kitchen Appliances

- _____ Refrigerator
- _____ Dishwasher
- _____ Range/Oven
- _____ Washer
- _____ Dryer

Bathroom Fixtures

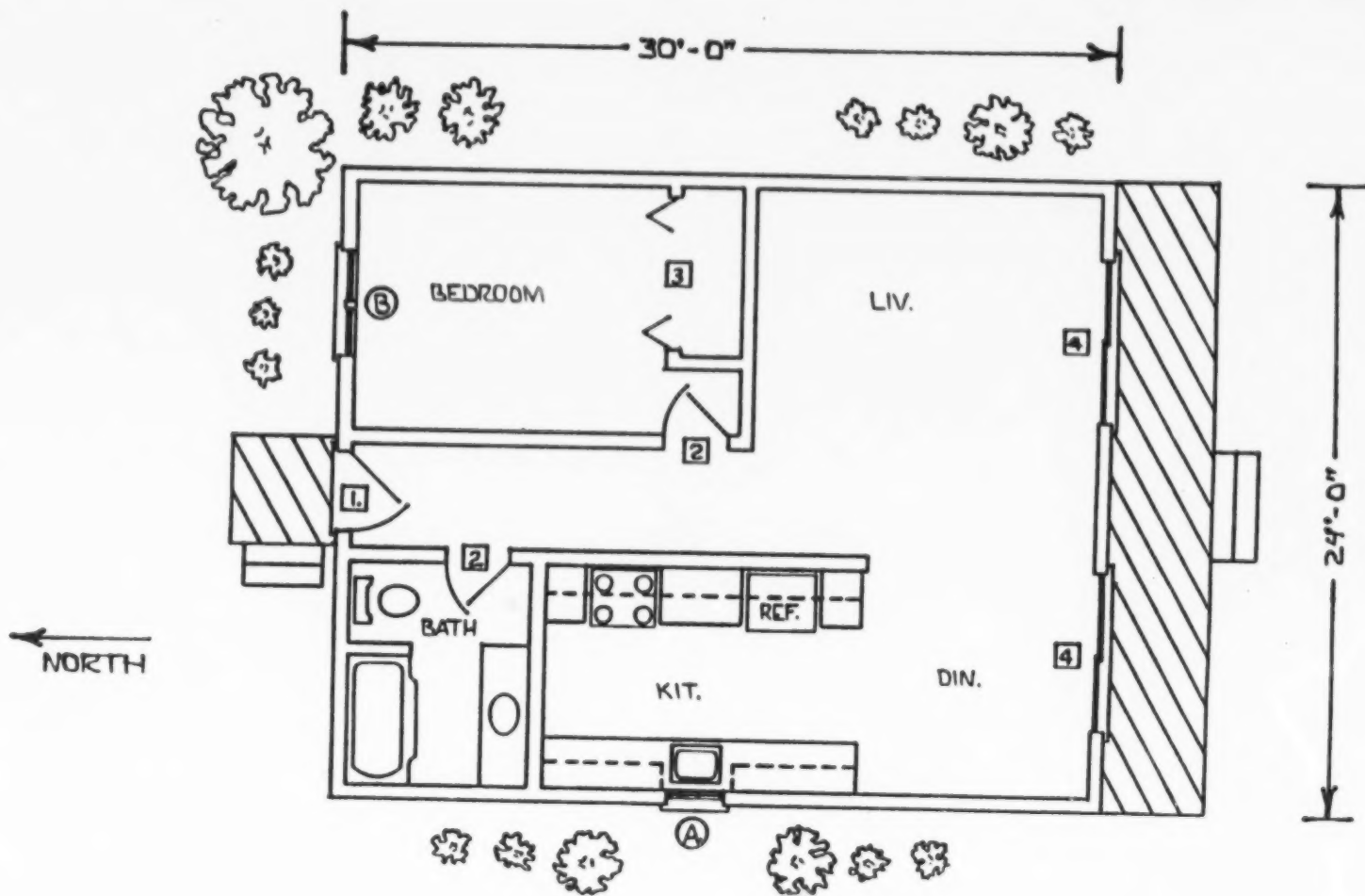
- _____ Vanity Lavatories
- _____ Shower Unit
- _____ Bathtub
- _____ Water Closet

6. Solar energy is available on the south side of a house for about six hours each day. The energy from the sun can be used to help heat and light the vacation home if it has windows facing south. Study your full size floor plan and determine which side of the house should be facing south to use solar energy. Label the side that should be facing south on the reduced floor plan below.



Activity Analysis

1. List three careers or jobs where people must be able to read and understand architectural drawings.
 - a. _____
 - b. _____
 - c. _____



NAME

VACATION COTTAGE
FLOORPLAN

DATE

SH #1

SKETCHING A SCHEMATIC DIAGRAM

Introduction

Pictorial drawings can show us how something will look before it is made and Multiviews can show us how to make something through several views. But pictorial and multiview drawings have limited communication value when it comes to complex electrical, electronic or fluid power systems. Imagine having to draw every part inside of a stereo, a television, or a video recorder.

Electrical, electronic, or fluid power systems contain more than one component (part or device). Each separate component could be communicated through pictorial or multiview drawings. However, when several components are connected, a special type of drawing is needed to communicate the relationship between the components. This special type of drawing which communicates technical information about electrical, electronic, and fluid power systems is called a schematic diagrams.

Schematic diagrams illustrate the system through symbols (SH #1). These simple symbols can be drawn quicker and easier than the actual components. Symbols are drawn the same whether the components are large or small. Single lines are used to show how components are connected. Schematics show how a system works more than how the system looks. The draftsman can locate symbols anywhere on a drawing as long as the system drawn will work. When the product is actually made, it will not look anything like what will show in the drawing.

Schematics have two basic applications. The first application is assembly. Since schematics show the relationship between the components, they can be used to assemble an electrical, electronic or fluid power system. The second application is servicing. It is very difficult to understand how a circuit (system) works by looking at it. The systems are very complex and can have hundreds of parts. A schematic shows the system in a simpler form. Schematics help service people understand how a circuit works.

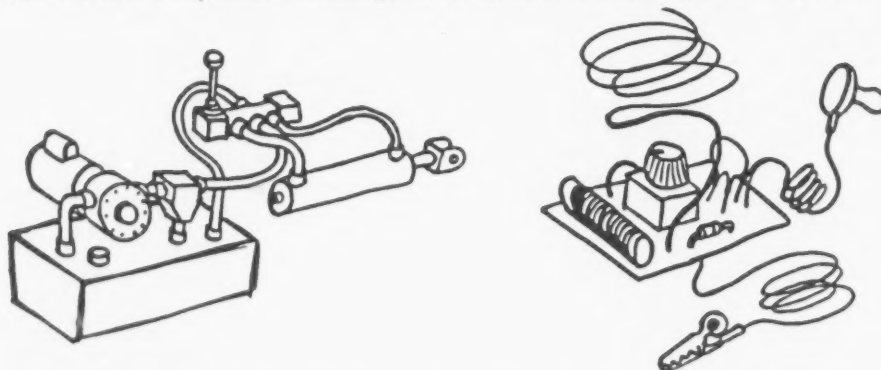
During this Technology Education Activity, you will learn how to create a simple schematic.

Materials and Supplies

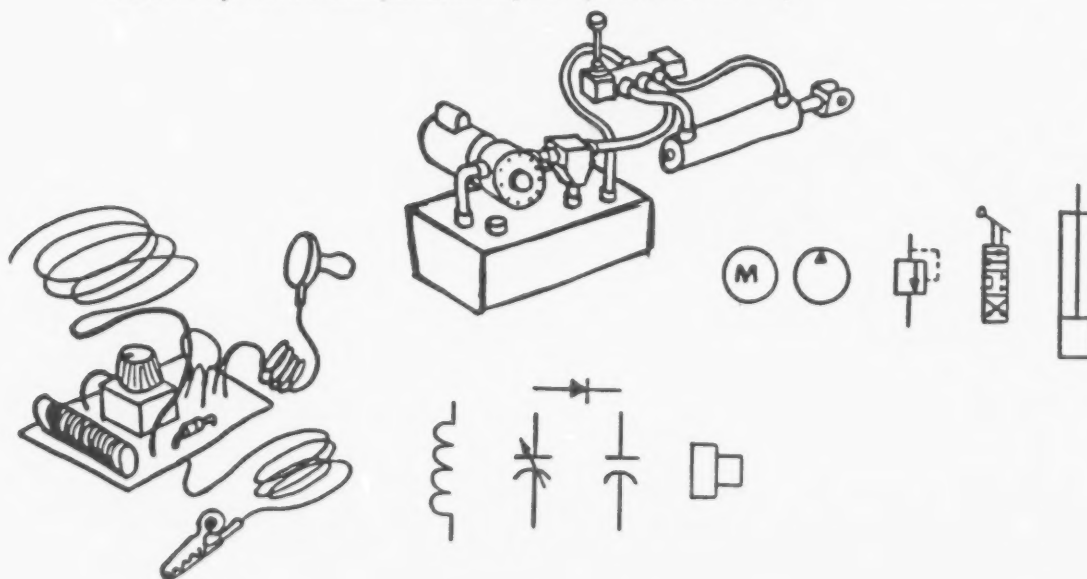
- Pencil
- Eraser

Activity Procedures

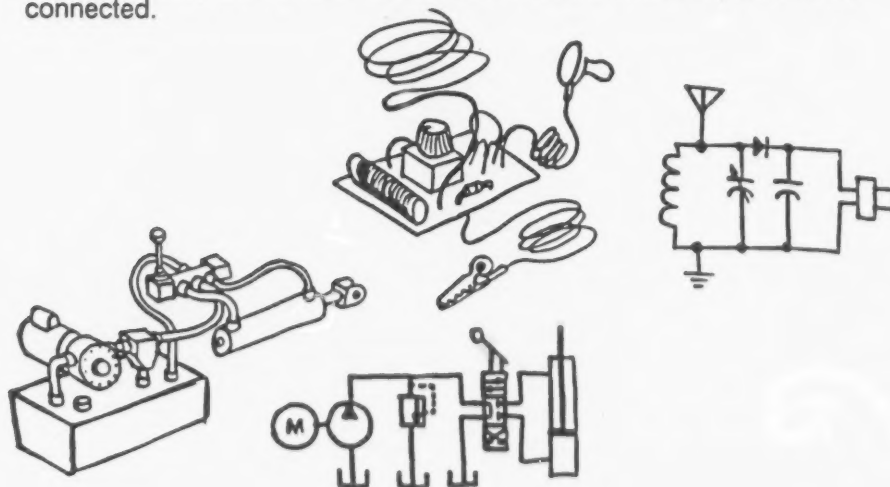
1. Using DR #1 and SH #2, create a schematic drawing of the stereo speaker system.
2. Begin by following steps and examples provided below.
 - a. The first step in developing a schematic diagram is to analyze the system. You need to know the names for the components and how they are connected. Shown below are pictorial drawings of an electronic and a hydraulic system.



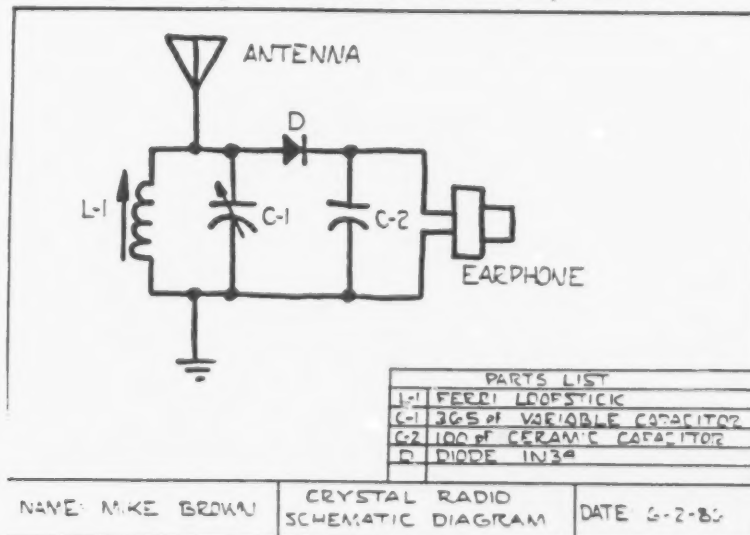
- b. After you understand how the system is put together, you can begin laying out the schematic diagram. Identify the symbol used for each component and sketch it on your paper. When you locate the symbols on your paper, try not to crowd them in any one area. Space your symbols equal distances apart from one another. The distance between symbols should allow space for a label. You can either lay out the symbols horizontally or vertically. Look at the two examples below. Both have most of their symbols layed out vertically. You may need to lay out the components of your system horizontally.



- c. Once you have all your symbols laid out, it is time to connect them together. Use lines to show how pipes, hoses or wires connect each component together. Pick a symbol and trace the path from it to the next symbol. By drawing straight lines, show the traced path on your diagram. Continue tracing and drawing paths until all the symbols are linked together and the circuit will work. Look at the examples below. Only vertical and horizontal lines were used to connect the symbols. Wavy lines should not be used to show how components are connected.



- d. Your schematic diagram needs to show what size or type of component is being represented by each symbol. A simple label needs to be placed next to each symbol. Detailed information about each component is provided in a parts list. See the example below. Use the labels and information provided on your pictorial drawing to label your schematic and make a parts list.



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- e. Your schematic diagram should communicate a circuit used to separate high and low sounds in a two-way speaker (a speaker containing a woofer and a tweeter). Erase the unwanted lines and darken in all the object lines. Put your name and the date in the title block. Make sure your drawing is free of mistakes before you turn it in for a grade.

Activity Analysis

1. Explain what a schematic is?

2. Sketch the correct schematic symbol next to the following:

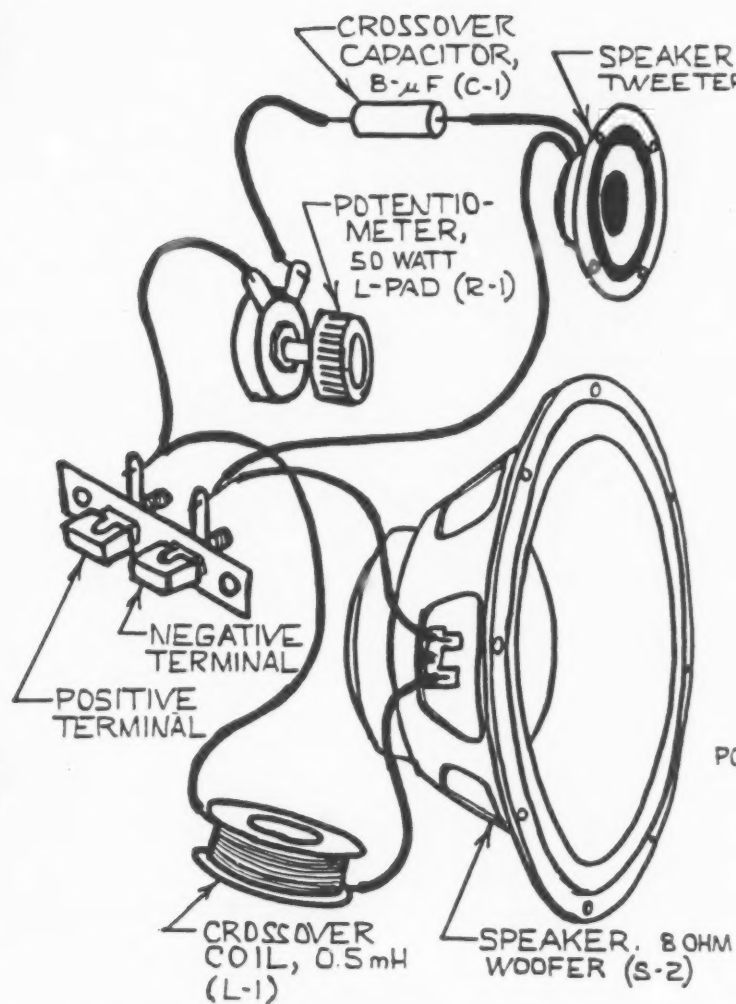
Electrical

- a. battery
- b. speaker
- c. bulb
- d. switch

Fluid Power

- a. pump
- b. valve
- c. electric motor
- d. reservoir

3. List two basic applications for schematics



ELECTRONIC SYMBOLS

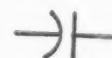
COIL



POTENTIOMETER



CAPACITOR



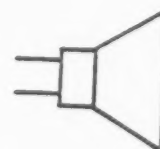
POSITIVE TERMINAL



NEGATIVE TERMINAL



SPEAKER



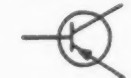
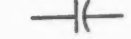
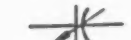
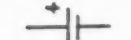
CONDUCTOR PATH (WIRE)



CONDUCTOR CONNECTION



ELECTRONIC SYMBOLS

	COIL, FERRI LOOPSTICK
	TRANSISTOR
	CAPACITOR
	VARIABLE CAPACITOR
	DIODE
	RESISTOR
	BATTERY
	SWITCH
	GROUND
	ANTENNA
	EARPHONES

FLUID POWER SYSTEMS

	ELECTRIC MOTOR
	HYDRAULIC PUMP
	HYDRAULIC MOTOR
	4-WAY, 3-POSITION VALVE
	PRESSURE RELIEF VALVE
	DOUBLE-ACTING CYLINDER
	RESERVOIR (OIL TANK)

PARTS LIST	

NAME	DATE
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SH #2

READING A SCHEMATIC DIAGRAM

Introduction

The use of electronics and fluid power technology in industry is growing. Industry needs people who can design, manufacture, and service electronic and fluid power systems. Schematic diagrams are a common way of communicating technical information about electronic and fluid power systems.

When engineers and technicians need to design a new system, they sketch their ideas on paper. Schematic diagrams can be used to record and compare system design ideas. It is important that all the members of a design team understand how to read their team member's ideas.

Once a system has been designed, it must be built and tested. This is often the job of a technician who reads the design team's sketches. After the technician builds the system, he tests it and recommends changes in the design. These changes are recorded in the form of a schematic.

After designing and testing, the system is manufactured. Schematic diagrams are used to show production people how to assemble the electronic or fluid power systems. Diagrams communicate the location of each part of a system -- some electronic systems require hundreds of tiny parts to be assembled.

Unfortunately, some systems will break down and need repair. Because it is difficult to understand how systems work by just looking at one, service people need to know how to read a schematic diagram to be able to fix them. An electronic system could include hundreds of components compacted in a small space. A fluid power system could be spread out over a long assembly line. Whether it is big or small, a system is easier to understand if you can read a schematic before trying to repair it.

During this Technology Education Activity, you will learn how to read a simple schematic diagram.

Materials and Supplies

- Pencil
- Eraser

Activity Procedures

1. You are interested in electronics and want to build a radio. You found a schematic for a simple radio in an electronics magazine (SH #1). Before you go to the electronics store, you need to check the parts list and make sure it includes all the components needed to build the radio. Read the parts list carefully. Using the symbol table below, finish labeling the symbols on your schematic so they match the parts list.



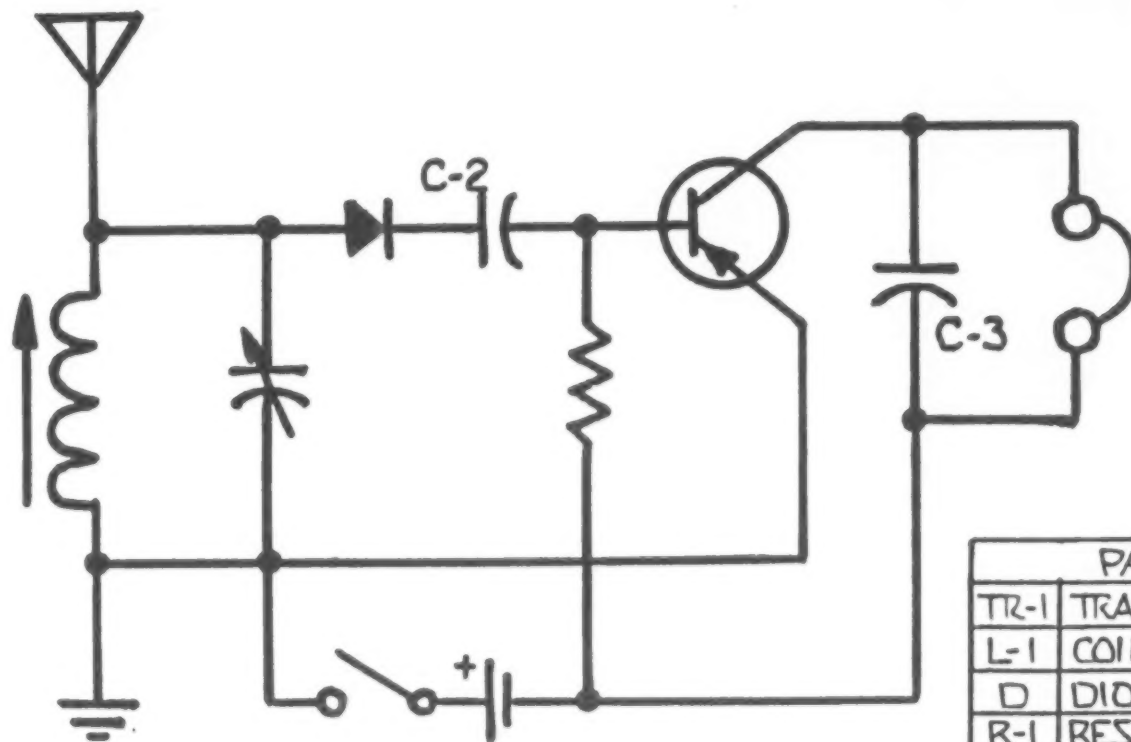
2. You have all the components necessary to make the radio. Read the schematic diagram and answer the following assembly questions.
- a. The diode and capacitor C-2 must be soldered between _____ and _____.
 - b. The Ferri Loopstick is located between the _____ and the ground.
 - c. One end of resistor R-1 is connected to capacitor C-2 and transistor TR-1. The other end of the resistor is connected to _____ and capacitor _____.
 - d. The leads of transistor TR-1 are connected to resistor R-1, capacitor C-1, and _____.
 - e. You do not want to get capacitor C-2 and capacitor C-3 mixed up. What size capacitor is used in location C-2 and C-3?
C-2 is a _____ capacitor.
C-3 is a _____ capacitor.
 - f. What size battery does this radio need?
B-2 is a _____ volt battery
 - g. What is special about capacitor C-1?
C-1 is a _____ capacitor

Activity Analysis

1. Explain what type of information can be communicated on an electronic schematic?

2. What type of jobs and careers require the use of schematic diagrams?

65-D



PARTS LIST	
TR-1	TRANSISTOR, 2N107
L-1	COIL, FERRI LOOPSTICK
D	DIODE, 1N295
R-1	RESISTOR, 470 K Ω
S-1	SWITCH, SP
B-1	BATTERY, 9 VOLTS
E-1	EARPHONE
C-1	VARIABLE CAP, 20-365 pf
C-2	CAPACITOR, .02 μ F DISK
C-3	CAPACITOR, .1 μ F PAPER

NAME: MIKE BROWN

TRANSISTOR RADIO
SCHEMATIC DIAGRAM

DATE: 6-3-86

SH 1

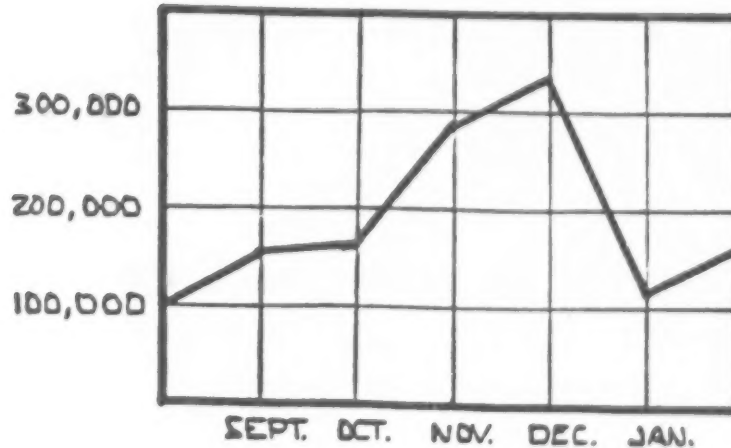
SKETCHING GRAPHS AND CHARTS

Introduction

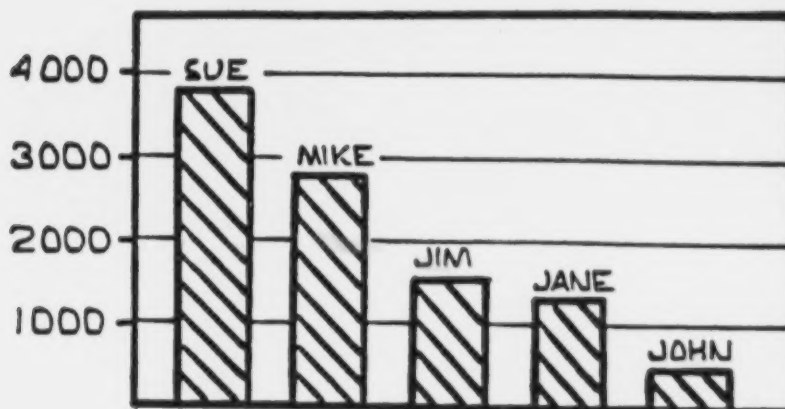
Pictorial and multiview drawings are used to communicate information about a shape and architectural drawings communicate information about a structure. Schematics communicate information about a system. Just like these drawings, graphs and charts are used to convert technical information into pictures. Graphs communicate information that is in the form of numbers. Charts communicate information about an organization or a process.

Graphs and charts are powerful communication tools in business and industry. Putting technical information in the form of a graph or chart makes it more interesting and easier to understand.

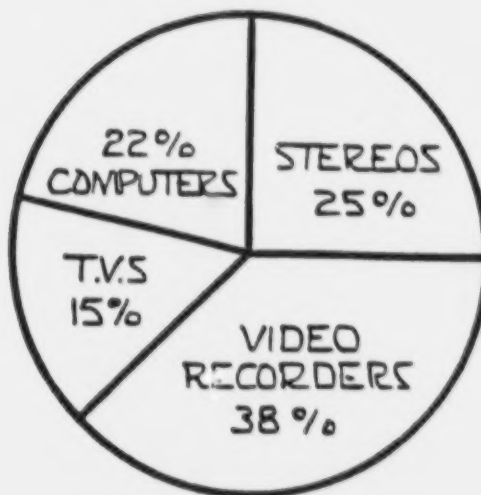
The three basic types of graphs are line graphs, bar graphs, and pie graphs. Line graphs are typically used to show trends or changes over time. The line graph below shows how store sales went up during November and December and dropped in January. Do you think Christmas had anything to do with the jump in sales?



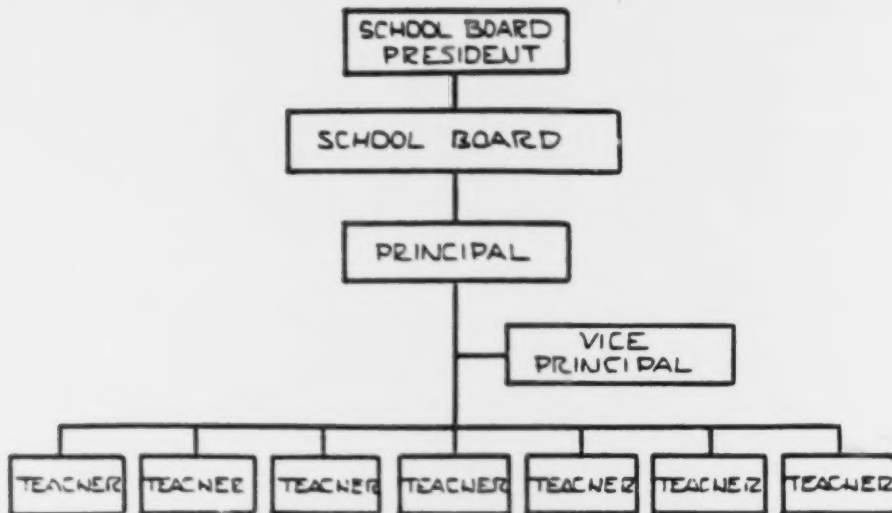
Bar graphs are often used to make comparisons. The bar graph below shows the amount of sales made by each member of the store's sales staff. Who do you think will be fired if he/she does not sell more products?



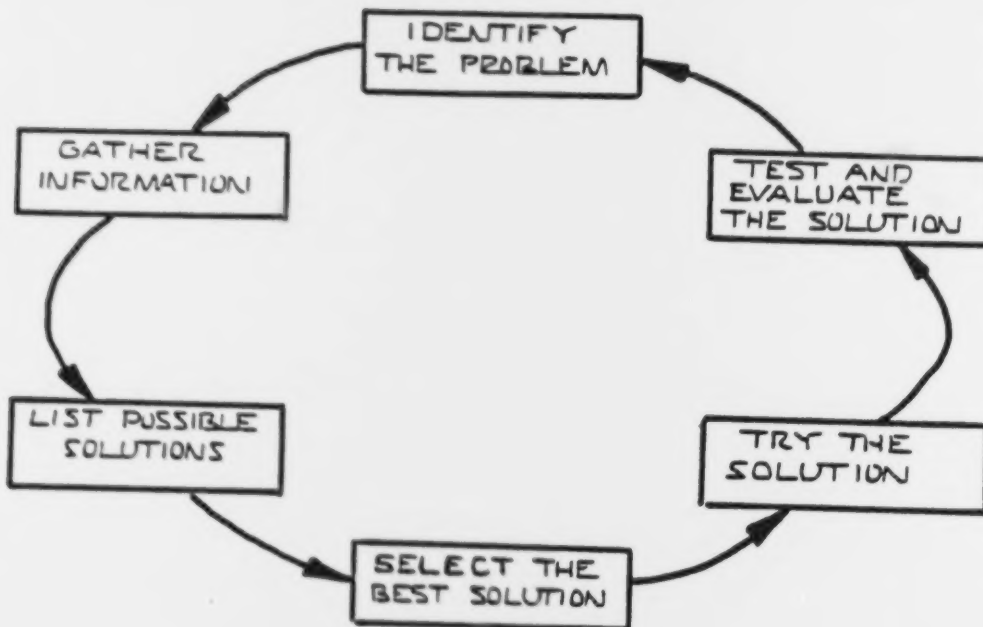
Pie graphs are used to show the parts of something in comparison to the whole (for example, how big a piece of pie is in comparison to the whole pie). The pie graph below shows how much of the store's December sales (whole) were gained from certain products (parts). What was the most popular Christmas gift purchased from this store?



Charts can also communicate complex information quickly and easily. The two basic types of charts are flow charts and organization charts. Flow charts show a process and organizational charts show positions. The chart below shows a typical organization structure for a school. Who has the highest position in a school?



Flow charts show the steps in a process in graphic form. The flow chart below shows the steps in solving a problem. According to this chart, does the process ever end?



Materials and Supplies

- Several pieces of graph paper
- Pencil
- Eraser

Activity Procedures

Sketching a Line Graph

1. The first step in sketching a graph is to study the data (numbers). Data is generally listed on a table. The data you will graph is on the table below.

Average Cost of a New American Car

Model Year	Average Cost
1970	\$3,708
1975	\$5,084
1980	\$7,609
1985	\$11,629
1990	\$13,980

(Motor Vehicle Manufacturers Assoc. of the United States, Inc.)

2. Using graph paper, draw a horizontal and a vertical axis. See SH #1. Graphs look the best when the horizontal and the vertical axes are about the same length.
3. The next step is to put a scale on each of the axes. Spread the scale along the full length of each axis.
4. Next step is to plot (locate) the data on the graph. The scales will be used to plot the points on the graph. Each point will represent a number from the table. Read the table and plot each point on the graph.
5. Once all the points have been located, connect each point with a line.
6. The next step in sketching your graph is documentation. The horizontal and the vertical axes have to be labeled. You may also want to include the data on your graph if the numbers are important.

Sketching a Bar Graph:

1. Bar graphs are a lot like line graphs. The first step is to study the data in the table. The data for your graph is listed in the table below. As needed, refer to SH #2 for an example bar graph layout.

Grand Slam Sluggers

Player (Team)	Number of Grand Slams
Dave Kingman (Oakland)	15
Eddie Murray (Baltimore)	14
George Foster (N.Y. Mets)	13
Reggie Jackson (California)	11
Don Baylor (Boston)	11

(Elias Sports Bureau, 1986)

2. You need to draw a horizontal and vertical axis on your graph paper just like you did before. Remember, your graphs will look the best if the horizontal and the vertical axis are about the same length.
3. Put a scale along the length of each of the axes.
4. Draw each bar needed to represent the data. Do not worry about their height yet. Draw each bar lightly so you can erase unwanted lines later.
5. Plot (locate) the top of each bar using the data in the table. Use scales to determine bar height. Each bar will represent a number from the table.
6. After you have drawn each bar, erase unwanted lines and darken in the graph.
7. The last step is documentation. Label the horizontal and the vertical axes. Write in the data on top of each bar if you want to.

Sketching a Pie Graph:

1. The first step in developing a pie graph is to study the data in the table. The data you will graph is listed below. As needed, refer to SH #3 for an example of a Pie Graph layout.

Energy Usage in the U.S.

Applications	Percent
Transportation	25%
Industrial	37%
Commercial	16%
Residential	22%

(U.S. Dept. of Energy, 1980)

2. Draw a circle about 5 inches in diameter for your graph.

3. The next step is to cut the pie into pieces. Read the first number listed on your table. This number represents a percent. On your graph, 1 percent is equal to 3.6 degrees. Multiply the number from your table by 3.6 degrees. This will give you the number of degrees for the first slice of the pie (or graph). Using a protractor, lay out the first segment (part). Repeat this process for each number listed on your table until the graph is complete.
4. Erase all unwanted lines and darken your graph.
5. The last step is to document the graph. Label each segment (part) and write in the percent.

Sketching an Organizational Chart:

The first step in making an organizational chart is to identify and rank the positions in the organization. Ranking is often based on authority and responsibility. Supervisory jobs are typically placed at the top of the chart. Workers are placed below the supervisors. Listed below are students and their assigned clean up jobs. Using graph paper, sketch an organization chart for this class's clean up activities.

Clean-up Assignments

Students	Clean-up Jobs
Mike	Clean-up Supervisor
Jim	Bench Supervisor
Sue	Hand tool Supervisor
Mary	Machine Supervisor
Kevin	Benches
Tim	Benches
Judy	Benches
John	Hand tools
Jane	Hand tools
Kim	Machines
Kris	Machines

Sketching a Flow Chart:

Flow charts illustrate a process. Communication is a process. The process starts with a sender and ends with a receiver. Listed below are the basic parts of the communication process on the graph paper. Using arrows and different shapes, make a flow chart that shows the communicating process. Label each part on the flow chart.

Sender
Encoding
Transmitting
Message
Receiving
Decoding
Receiver

Activity Analysis

1. List three types of graphs and their applications

- a. _____

- b. _____

- c. _____

2. List two basic types of charts and their applications

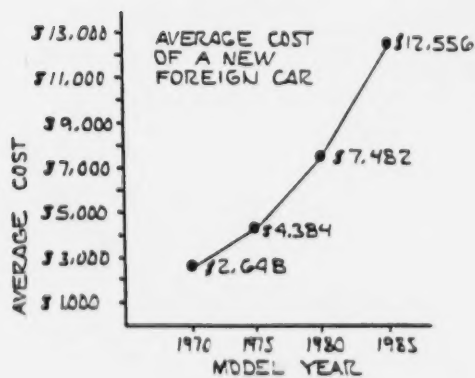
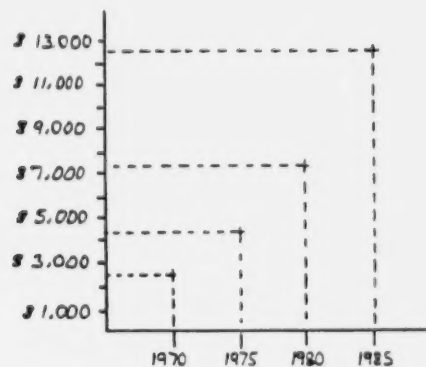
- a. _____

- b. _____

Average Cost of a New Foreign Car

Model Year	Average Cost
1970	\$2,648
1975	4,384
1980	7,482
1985	12,556
1990	13,980

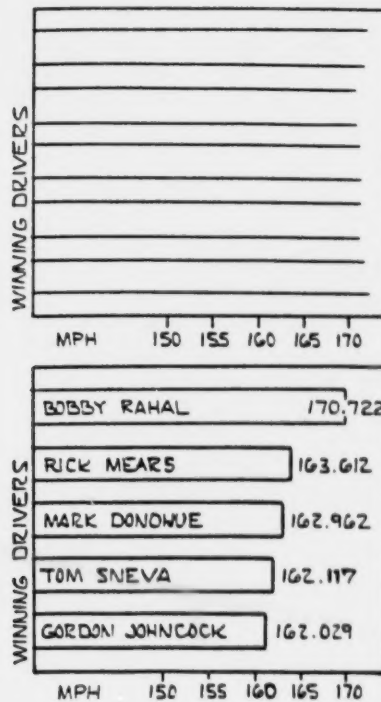
(Motor Vehicle Manufacturers Assoc. of the United States, Inc.)



Indianapolis 500 Speed Records

Winning Driver	MPH
Bobby Rahal (1986)	170.722
Rick Mears (1984)	163.612
Mark Donohue (1972)	162.962
Tom Sneva (1983)	162.1776
Gordon Johncock (1982)	162.029

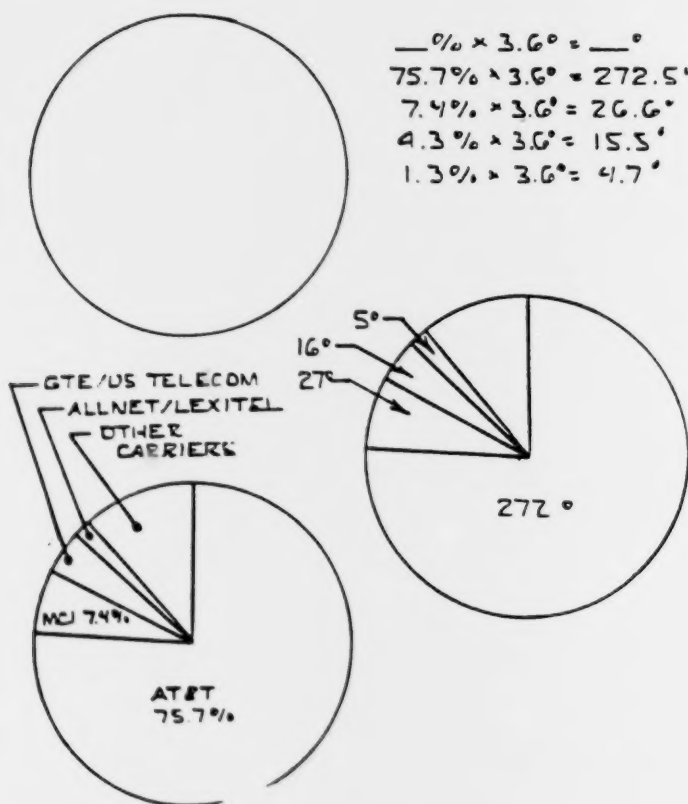
(USA TODAY Research, 1986)



Who Is Handling Our Long Distance Calls

Long Distance Company	Percent
AT & T	75.7
MCI	7.4
GTE/US Telecom	4.3
Allnet/Lexitel	1.3

(The Yankee Group, 1986)



READING GRAPHS AND CHARTS

Introduction:

Like all the other types of drawings you have studied, graphs and charts communicate technical information in the form of pictures. Graphs and charts make technical information more interesting and easier to understand. The drafter sending the information needs to know how to draw graphs and charts. The people who can benefit from the information must be able to read the graphs or charts. In your life, you will most likely read more graphs and charts than you will draw. Graphs and charts are common communication tools in science, industry, and business.

Scientists use graphs to record, study, and communicate the information they gather from experiments. Often the steps for the experiment are put in the form of a chart. In chart form, all the scientists and technicians involved in an experiment can understand their role and the roles of others.

Charts are popular communication tools in industry. Engineers and managers use charts to organize production people, materials and machines. Flow charts are used to record and communicate all the steps required to make a product. Charts are used to show how materials flow through the factor. Graphs are used to show the percentage of defective parts made or how well workers are doing their jobs.

Business people use graphs to show how much money the company is making, who is buying the company's products, and which products are selling best. Organizational charts are used to show each department in the company and who is the boss at each level of the company.

Graphs are used to compare one product with another product in consumer and automotive magazines. You may need to read a chart to find out what is the best product to buy. Charts are often used to illustrate points in a news story. Charts are also used to show the steps for do-it-yourself products and projects. Because graphs and charts are everywhere, consumers should be able to read them.

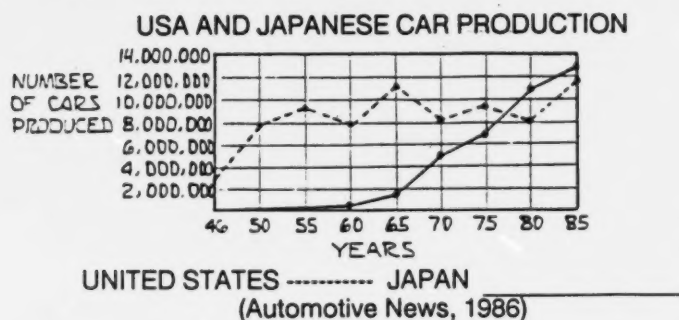
Materials and Supplies

- Pencil
- Eraser

Activity Procedures

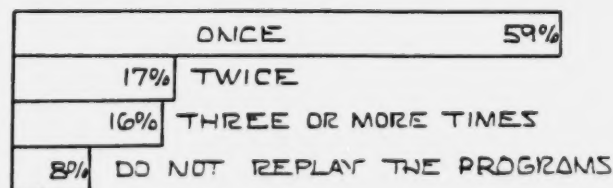
Reading Graphs and Charts:

- Using the graph below, answer the following questions.



- American automobile production was almost the same in 19__, 19__, 19__, and 19__.
 - The U.S. and Japan produced the same number of cars in about 19__.
 - Japan had the biggest lead on the U.S. in car production in 19__.
 - For the U.S., 1985 was a good year for producing cars. The U.S. produced almost as many cars in 19__ as it did in 1985.
 - In 1950, the U.S. produced about 8 million cars. Until what year did it take for Japan to make as many cars as the U.S. did in 1950?
 - Which country was the leader in car production in 1985?
- Using the graph below, answer the following questions.

How many times do people watch TV programs they record on videotape?



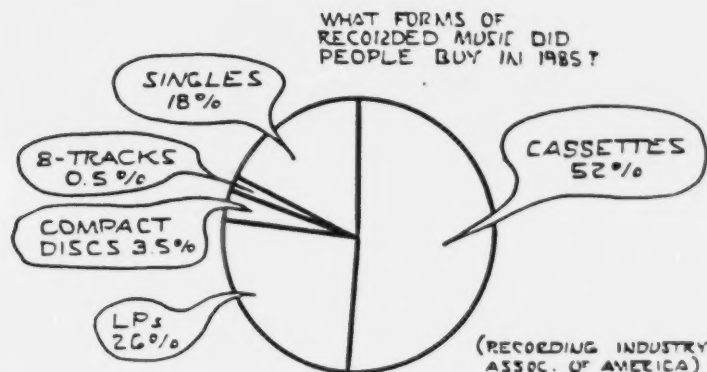
(Statistical Research Inc., 1986)

- About _____ percent of the people who record TV programs will only play them back once.

b. What percent of the people who record programs will watch more than once?

c. About _____ percent of the people who record programs do not even watch them.

3. Using the graph below, answer the following questions.



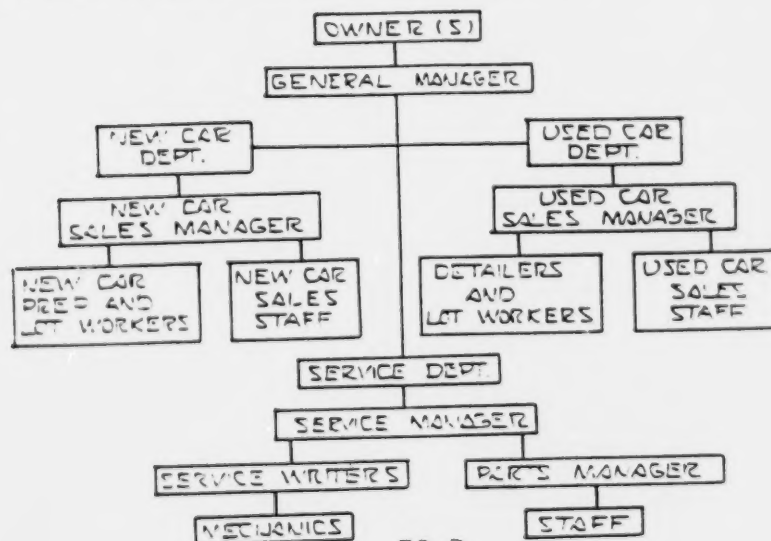
a. What is the most popular form for recorded music? _____

b. What is the least popular form for recorded music? _____

c. About 3.5 percent of recorded music is purchased on _____.

d. More people prefer buying _____ than all the other forms of recorded music put together.

4. Using the chart below, answer the following questions.

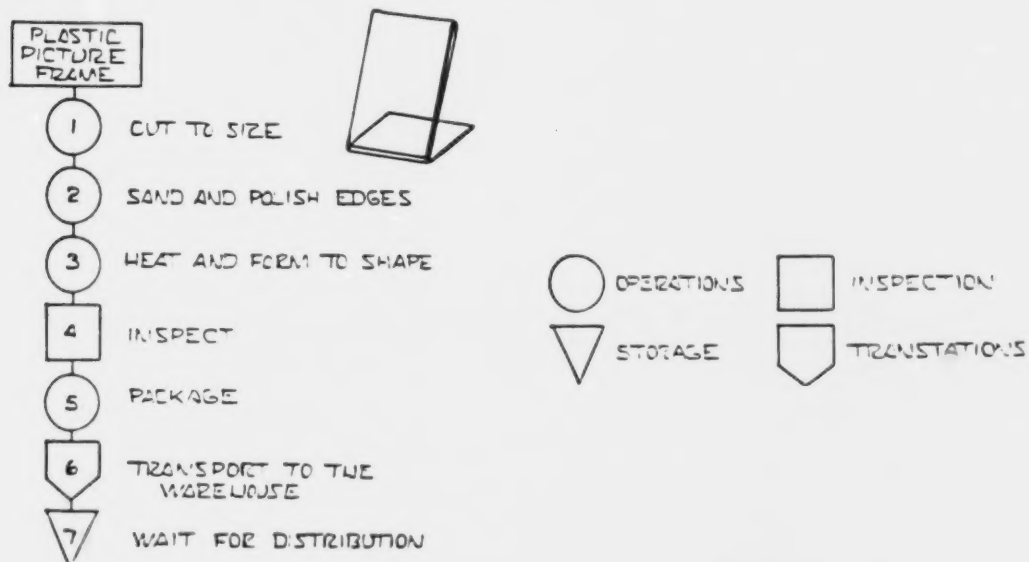


78-D

- a. The top person in a car deal organization is the _____.
- b. What are the three major departments in this organization?

- c. The new car manager, the used car manager, and the service manager, all report to the _____ manager.
- d. What are the two types of sales staff in this car dealer's organization?

5. Using the flow chart below, answer the following questions.



- a. How many operations have to be performed to make this product? _____
- b. The product is inspected after operation number _____.
- c. Before the product is transported to the warehouse, it must be _____.

Activity Analysis

1. Identify three places where charts and graphs are used to communicate information.

COMMUNICATION THROUGH THE USE OF MAPS

SUPPLEMENTARY DRAFTING/DESIGN ACTIVITY

Introduction

If you were wanting to drive to Walt Disney World in Florida for a vacation, how would you know how to get there? Well, you would probably use a road map. Maps are graphical representations of physical or geographical locations on earth and in space. Maps provide an information chart, direction, distance, physical and geographical land marks, and location and routes. Persons who make maps are called cartographers. They have the specialized skills required to design and draw, but they still use many drafting tools and techniques.

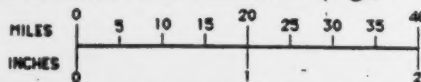
Maps are used for various types of transportation systems. Drivers using land transportation systems use road maps when planning vacation trips, determining distances between locations, locating major roadways, or finding the location of cities and towns. People using water transportation systems use nautical maps called navigational charts to determine the depths of canals and reefs, locate physical and geographical land marks, and find the location of ports and harbors. Fliers using air transportation systems use aeronautical maps to locate airports, find physical landmarks, (e.g., power lines, railroad tracks, towers, roadways), identify other planes' flight routes (e.g., private, commercial, and military) and locate restricted flying areas.

The use of maps is not limited to travelers, however. Geologists use topographical or geographical maps to find oil and valuable minerals. Topographical maps show the earth's physical features such as hills, valleys, streams, lakes, and trees in much more detail than does a road map. Architects and engineers need contour maps to plan and build buildings and highways. These types of maps are used to convey information about the geography of the area. The information that can be conveyed by maps is almost limitless. Each map has a different purpose and is used to communicate different things.

All maps have two things in common: 1) they consist of symbols, and 2) they are drawn to a particular scale. A useful map employs certain symbols to represent various physical or geographical features. A symbol is a simple object, mark or sign used to represent something else (SH #1 shows some common map symbols). Map makers use symbols to save time and avoid cluttering the map. A legend is used to explain the meaning of each symbol. By using symbols, it is possible to communicate a large amount of information, using very little space.

A map allows use to carry the world around in our pocket because it is a scaled-down representation of reality. Scale means that a distance as shown on the map appears in a proportional relationship to a corresponding distance on the ground. It is a ratio of the distance on the drawing to the distance in reality. The choice of scale is of primary importance because it sets a limit on the information that can be included in the map and the degree of reality with which it can be delineated. The scale of some features on a map may have to be exaggerated so that they will be noticed by the map user. The relationship between a map and reality depends on the map's purpose and the size of the area being mapped. For example, a map of Disneyland would have a larger scale than a state or regional highway map.

The scale can usually be found in the legend box. There are many ways to show the scale. Three of the most common are: 1) by a scale statement or inch statement (e.g., 1" = 1' 6", one inch = one foot), 2) graphic or bar scale (e.g., 3) representative fraction (e.g., 1:12).



This Technology Education Activity will provide you with an opportunity to experience communicating graphically and visually through the use of maps. You will design and draw a map using either traditional or computer-aided drafting/design tools and techniques.

Materials and Supplies

Each student will need:

- a ruler
- a straightedge
- graph paper (1/4" grid)
- scissors
- tape, glue, or rubber cement
- access to traditional or computer-aided drafting/design tools and equipment

Problem Statement

Some of your relatives are coming into town and would like to watch you play in your soccer game. The game is being played at a local elementary school. The relatives know how to get to the high school, but not to the elementary school. They have asked that you design a map showing the best way to get from the high school to the elementary school.

Activity Procedures

1. Obtain a piece of graph paper from your instructor (SH #2).
2. Use the graph paper to create a sketch of a map showing a route from the high school to the elementary school

Does the map answer the following questions:

- Does the map solve the problem?
- Is the map understandable?
- Can you follow the map?
- How could the map be better or more easily understood?

In addition, make sure the map includes the following:

- proper distances and proportions of items
- proper location and direction of physical and geographical landmarks
- proper use of symbols

3. In a class discussion, be able to discuss your map with other students. Also be able to analyze your classmates' maps using the criteria described above.
4. After the class has analyzed their maps, refine the sketches. Obtain the handout of map symbols (SH #3), a pair of scissors, and a container of rubber cement.
5. Cut out the various symbols from the handout and adhere them to your sketch in the

appropriate place. (NOTE: Draw and add any symbols that you feel should be included and were not part of the handout).

6. Next, develop a map legend. The legend should include all of the symbols used on the map.
7. Glue the legend on the map.
8. Title the map. Then identify the side of the map facing north. This should be done by drawing an arrow in the proper direction and placing the letter (N) or word (North) under it.
9. Once the refined sketch has been completed, have your instructor check your work.
10. Once your instructor has checked your work, it is time to create your final drawing. (NOTE: If you are not familiar with the concept of scaling, you should complete the optional scaling exercise before going any further.)
11. Using either traditional or computer-aided design tools and techniques to create your final drawing. Be sure your drawing is neat and accurate. Remember it should be able to be understood by another person, such as a relative.
12. The completed map should include the following:
 - a title
 - a legend
 - appropriate symbols
 - correct scale designation
 - identifies which way is north
13. Be able to discuss your map design with the rest of the class.

Activity Analysis

1. Are maps more or less important to you than to your grandparents? Explain why?

2. How are maps being used today?

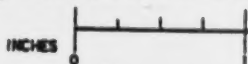
3. How might they be used differently in the future?

Optional Lab Activity - Drawing to Scale

Before you begin drawing the sketch of your map to scale, it is important that you understand how to draw objects to scale. The following activity is designed to explain how to take an object from full scale and reduce to various scales.

Many things are too large or too small to be drawn true size. Therefore, it is necessary to draw them "to scale," meaning, drawn to a size different than true size. To find out just what this means, you may try an activity where you will draw an area to scale. The area you will draw is the top of your desk.

1. With a ruler measure the top of your desk.
 - a. My desk is _____ inches wide.
 - b. My desk is _____ inches long.
2. Near the top of the piece of graph paper provided make a scale drawing of your desk top. **Read the rest of this paragraph and work out exercises a and b at the end before you begin to draw.** Let 1 inch in your drawing stand for 12 inches on the actual desk top. Suppose for example, your desk is 21 inches wide and 27 inches long. In your drawing, 1 inch is to stand for 12 inches. To find out how wide to make your drawing, you must find out how many times 12 will go into 21. Dividing 21 by 12, you get $1\frac{3}{4}$ as your answer. The rectangle you draw must be $1\frac{3}{4}$ inches wide. Divide 27 by 12, you get $2\frac{1}{4}$ inches. Now work out the problems for the measurements of your own desk top. Use the width and length you found for your own desk.
 - a. My drawing will be _____ inches wide. (desk width divided by 12)
 - b. My drawing will be _____ inches long. (desk length divided by 12)
3. You have outlined the shape of your desk top. No one but you knows what it is. Above your drawing write **MY DESK TOP**.
4. You know that 1 inch on your drawing stands for 12 inches on your desk top, but no one else knows unless you tell them. Under the drawing of your desk top write **"SCALE 1 to 12."**
5. There is another way to tell what scale you have used. Under your desk top drawing, draw a line 1 inch long. Divide it into fourths with short lines. It should look like this:



The numbers stand for inches in your drawing. Anyone could copy this scale and use it like a ruler to measure the size of your desk top from the drawing.

6. Under the first drawing of your desk, make another. This time let 1 inch stand for 6 inches on your desk top.
 - a. My drawing will be _____ inches wide. (desk width divided by 6)
 - b. My drawing will be _____ inches long. (desk length divided by 6)

7. Under your new drawing, show the scale you used, just as you did for the first drawing. This time your scale is 1 to 6. For your measuring scale, draw a line 2 inches long.
8. Now you have made two drawings of your desktop. Both were drawn to scale, but they were not drawn to the same scale. Both drawings should be the same shape, but the second should be twice as wide and twice as long as the other.

There are many ways to illustrate what scale you used. You might have written the scale for your first drawing in one of the ways shown below, while all mean the same thing.

- a. Scale 1:12 (R.F. scale or representative fraction)
- b. One inch equals 12 inch
- c. One inch equals 1 foot
- d. One inch = 12 inches (scale statements)
- e. One inch = 1 foot
- f. 1 foot to 1 inch
- g. 1 inch represents 1 foot
- h. graphic or bar scale

Maps are always drawn to scale because it is not possible to draw them full size. The size of the land area being mapped will determine the scale. The larger the land area that you want to represent on a map, the smaller the scale must be drawn.

WHAT IS A SYMBOL?

a simple object, mark, sign or picture used to represent or stand for something else

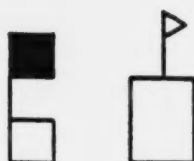
HOSPITAL



BRIDGE



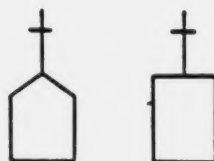
SCHOOL



ROAD



CHURCH



RAILROAD



HOUSE



CITY LIMITS



TRAILER PARK



RIVER/CREEK



CEMETARY



LAKEPOND

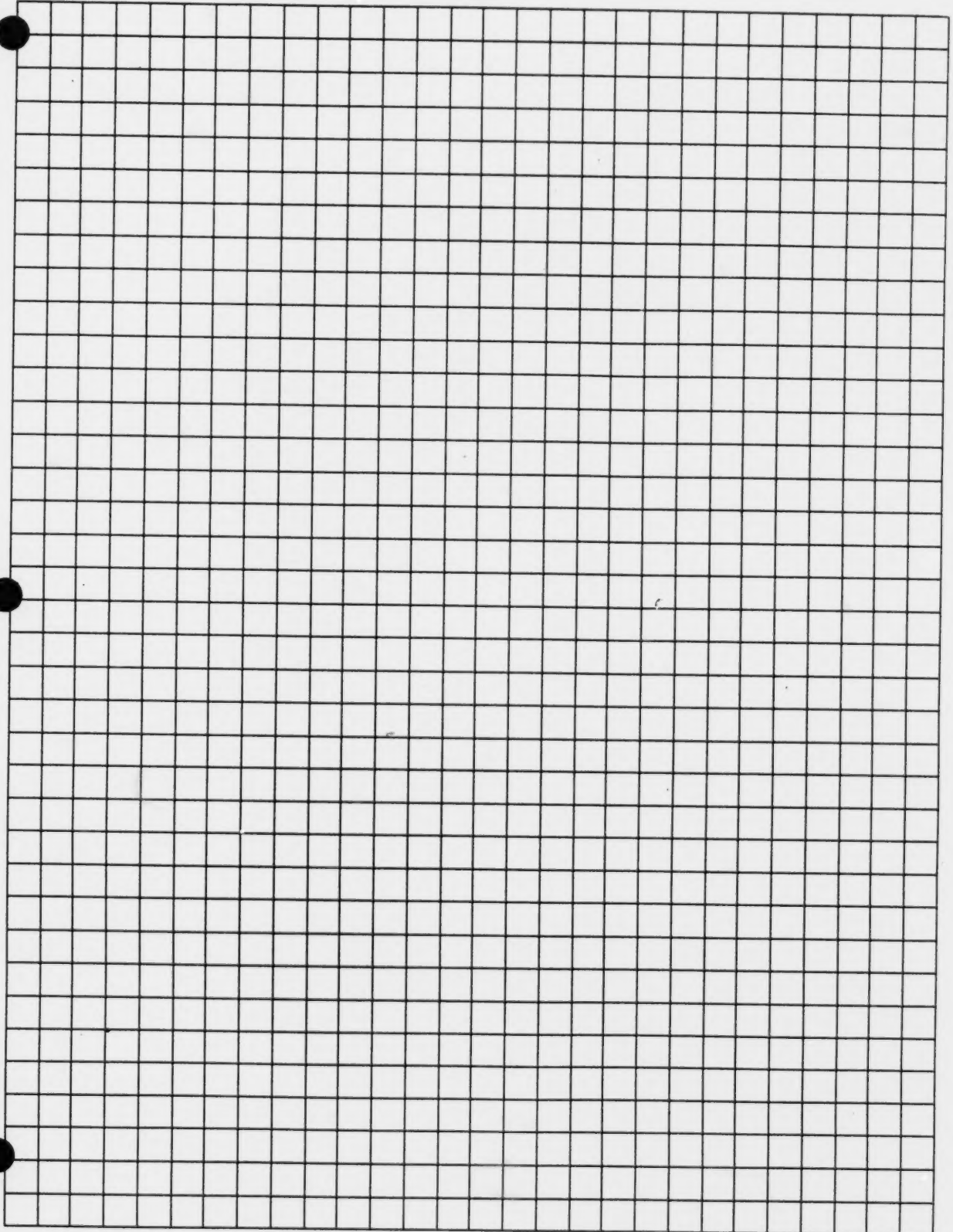


GOLF COURSE

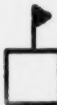
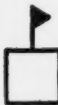
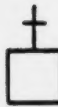
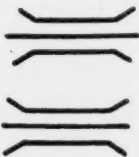
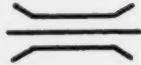


AIRPCRT





MAP SYMBOLS

Hospital				House/Building			
School							
Church							
Trailer Park							
Golf Course							Airport
Cemetery							
Bridge							

PHOTOGRAPHY

PHOTOGRAPHY

Suggested Learning Objectives

Upon completion of the photography unit, students will be able to:

- A. Define and properly use common photography **terminology** like composition, exposure, projection, aperture, depth of field, and telephoto.
- B. Identify basic **applications** for photography technology including complementing and enhancing written messages, keeping and producing records, researching life and motion, advertising products and services, and facilitating artistic expression.
- C. Describe the societal and environmental **impacts** associated with photography technology including the utilization of precious metals, disposal of hazardous chemicals, and recording of historical events. SC2
- D. Describe basic **processes** like preparing, composing, lighting, exposing, developing, stopping, fixing, washing, enlarging, mounting, sequencing, projecting, and presenting. SC1
- E. Describe the natural, human, financial, informational, material, and technological **resources** associated with photographic processes and enterprises (e.g., silver, light, subjects).
- F. Describe the major milestones in the **history** and evolution of photography including the invention of camera obscurity, the introduction of Kodak and Polaroid cameras, and the development of hologram technology. SS2
- G. Identify potential **safety** hazards, establish guidelines for safe behavior, and adhere to common safety practices when working with photographic equipment, materials, and chemicals. PH3
- H. Identify and evaluate **career** opportunities relating to photography (e.g., photographer, photo lab technician, photo journalist) based on their interests, talents, and career expectations.
- I. Describe the equipment, chemicals, and processes used to develop light sensitive materials including photographic paper, as well as black and white, color, and slide film. SC4
- J. Determine the appropriate exposure for a given subject based on lighting, motion, depth of field, color, and film speed considerations.
- K. Apply basic mathematical concepts to do things like time photographic processes and determine appropriate shutter speed and aperture settings. MA2

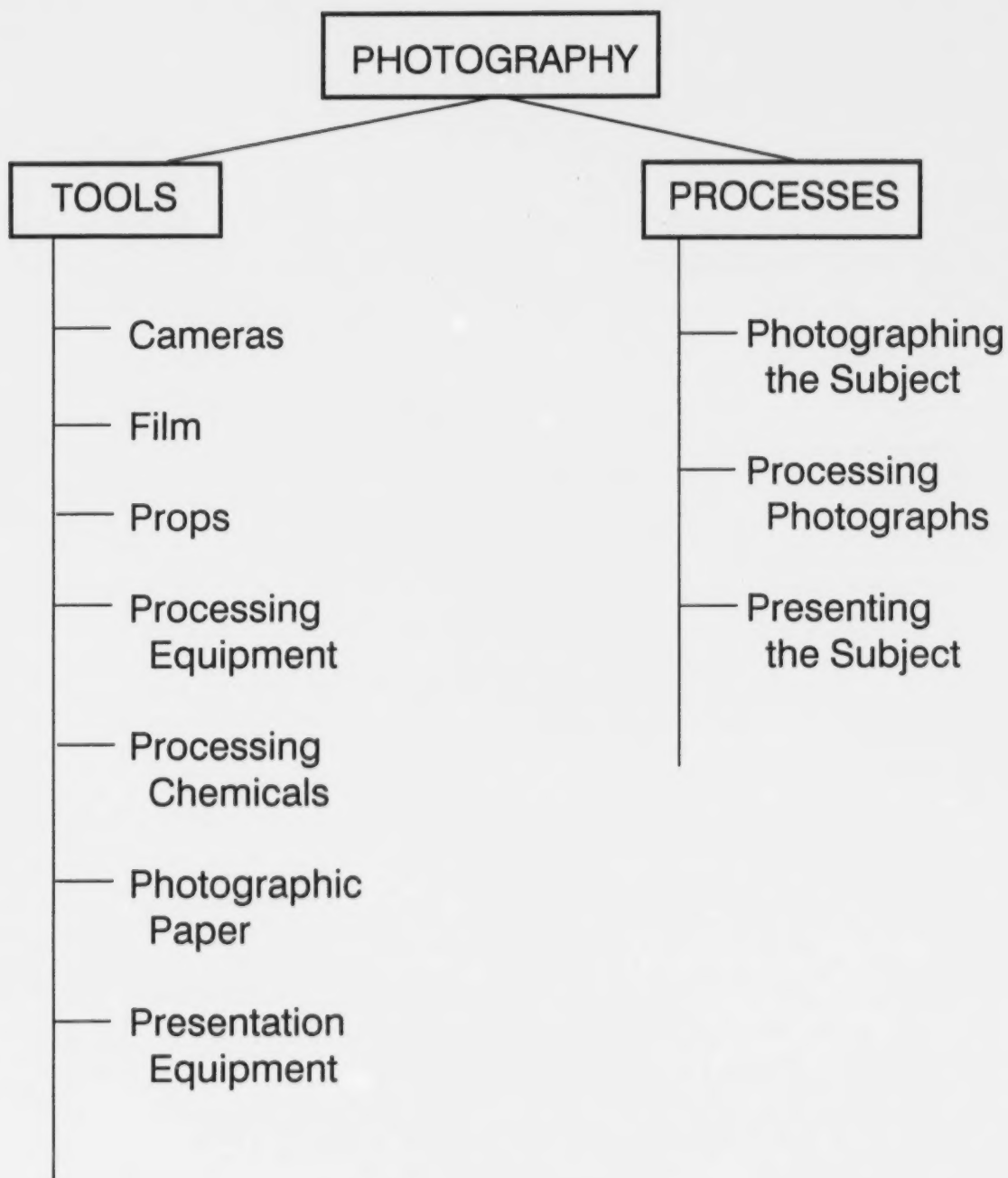
- L. Explain how scientific concepts like reflection, refraction, and focal plan apply to cameras and photographing images. SC1
- M. Using common photographic equipment, materials and services, perform basic photographic processes like lighting subjects, photographing subjects, developing film, and projecting images.
- N. Evaluate and compose photographs using the basic rules of composition such as the rule of thirds, framing subjects, screening the background, and using contrast. FA1
- O. Evaluate photographic presentations based on composition, exposure, content, sequencing, and audience considerations.
- P. Determine the best photographic equipment and materials for preparing and presenting a media presentation based on production, audience, content, environment, time, and cost considerations.
- Q. Prepare and make a photographic presentation addressing a given communication problem based on audience, content, environment, time, and cost considerations.
- R. Forecast how an audience will respond to specific photographs and photographic presentations.

Suggested Learning Activities

1. Introduce students to the concept of recording images on a light sensitive material. Have students make photograms by placing opaque, transparent, and translucent objects on a sheet of photographic paper and exposing it to light. Develop the photographic paper and discuss how the different objects affected the exposure. Ask students to describe how the ability to use light to record images has influenced our culture.
2. Discuss the basic elements needed to record an image on to a light sensitive material (i.e., light-tight box, film, aperture, shutter, viewfinder, lens). Using simple materials, have each student make a pin hole camera. Use the homemade cameras to photograph a variety of objects. Encourage students to experiment with the amount of time and light used to expose the film. Ask students to identify the basic parts on a variety of cameras.
3. Discuss how photography is used to enhance communication during training, sales, and public relations presentations. Divide the class into small groups and have each group identify and describe a presentation topic. Potential presentations could describe how to boot a diskette in a computer, use a machine in the laboratory or load film into a camera. Ask students to explain how photography can be used to complement and enhance written and verbal communication. Discuss the importance of supporting text with pictures and pictures with text.

4. Explain how photographic presentations have to be planned to achieve communication objectives. Have each group develop a story board describing the sequence of the verbal and visual information needed to address their presentation topic. Each story board should include an introduction, a content presentation, and a list of closing credits. Ask students to describe the difference between taking professional photographs and snap shots. Have students forecast how their photographic presentations will be received by an audience.
5. Explain how to use the basic rules of composition to compose and evaluate photographs, including techniques like the rule of thirds, framing the subject, screen background, adjusting the depth of the field, and using contrast. Ask students to evaluate a variety of photographs and identify examples of good and poor composition. Have students apply the basic rules of composition during subsequent learning activities. Discuss the importance of using good composition to enhance the aesthetic quality of photographs.
6. Show students how to use a simple camera to take photographs. Include processes like loading film, advancing film, adjusting film speed, focusing the camera, setting the exposure, activating the shutter, and rewinding film. Have students use popular photographic equipment to take photographs of a variety of subjects. Ask students to describe how they can use photography to capture and record important moments.
7. Show students various types of cameras and film and discuss their advantages, disadvantages, and applications. Divide the class into small groups and have each group determine the best camera and film to use to solve a given problem. Possible problems could include identifying the heat produced by an object, taking snapshots of family events, recording an indoor event without flash, conducting a presentation to a large group of people, or making a poster size print. Ask students to identify the consequences of selecting the wrong type of film or camera for a professional photography assignment.
8. Explain how professional photographers conduct photo sessions. Discuss how they use graphics, lighting, props, and models to create and compose the subject being photographed. Have students compose and photograph the subjects for each frame of their story board. Ask students to identify and discuss the aesthetic, ethical, and communication considerations that need to be addressed when taking photographs.
9. Explain the importance of controlling and balancing the amount of light and exposure time used to photograph various types of subjects. Using adjustable cameras, have students photograph a variety of stationary and moving objects. Ask students to determine and record the appropriate aperture and shutter speed settings for photographing a moving vehicle, cloud, child, landscape, or one person in a crowd. Have students evaluate photographs based on lighting, motion, and subject considerations.
10. Demonstrate the materials and processes used to develop film. Using laboratory equipment and chemicals, have students develop their film. Include processes like removing film from its canister, preparing the film for development, and developing, stopping, fixing, washing, and drying negatives. Have students explain why it is important to follow established procedures when developing film.

11. Explain how negatives are used to produce prints. Using basic darkroom equipment, have students make prints from their negatives. Include processes like adjusting and focusing an enlarger; cleaning and positioning negatives; making, developing, and analyzing test strips; positioning and exposing photographic paper; and developing, stopping, fixing, washing, and drying prints. Have students examine the ethical issues related to manipulating photographs to communicate false or biased information.
12. Discuss how photographs are assembled, sequenced, mounted, and displayed for museum, public relations, and trade show presentations. Using colored paper, poster board, spray contact cement, and/or dry transfer paper, have each group create a photographic presentation by selecting, sequencing, and mounting their photographs and captions on a large story board or display. Ask students to identify the advantages and disadvantages of presenting information through photographs and captions.
13. Explain how slides can be used to make presentations. Using a slide projector, screen, and cassette recorder, have each group select and sequence their best slides; record their script and cues on cassette tape; and preview their slide presentation. Discuss the flexibility and communication value of slide presentations. Have students compare and contrast slides with other forms of presentation media (e.g., photographs, films, video tapes).
14. Introduce students to the three basic types of presentations (i.e., person-to-person, small group, large group). Discuss the room, seating, equipment, and format considerations for each type of presentation. Have each group practice, promote, prepare and present their presentations to the class and invited guests. Using a teacher-made evaluation instrument, have each member of the audience evaluate the script, photographs, and presenters. Ask each team what they would change if they had to make their presentation again. Have students describe the consequences of a good presentation in a variety of business and industry contexts.
15. Discuss the milestones in the history and evolution of photography technology. Assign each student a historical event. Using library resources, have students gather information and develop an abstract describing the people, dates, places, and impacts associated with their assigned event. Encourage students to illustrate their abstracts. Post each abstract on a large timeline. Ask students to describe how given events influenced our culture and subsequent technological developments.
16. Discuss the career opportunities in photography technology. Include occupations at the nonskilled, semiskilled, skilled, technician, and professional levels in the discussion. Using library and guidance resources, have students gather information and present a short written or verbal report about an occupation related to photography technology. Each report should include information about the educational requirements, working conditions, benefits, salary, and advancement potential related to the occupation. Ask students to evaluate the career based on their interests, talents, and career expectations.



INTRODUCTION TO PHOTOGRAPHY

Introduction

Like the old saying goes, "a picture is worth a thousand words." We live in a world full of pictures. Many of the pictures we see around us were made with the aid of photography. Photography is storing information on a light sensitive material. It can be used to accurately record and communicate a lot of information in a short period of time. It is a tool that can be used for communication, image processing, record keeping, research, and artistic expression.

Photography allows us to capture a moment in time in the form of a picture. The picture itself is the direct result of light bouncing off a subject and striking a light sensitive material. Therefore, photography can be defined as storing information on a light sensitive material.

Photography has several advantages over other forms of communication. A photography can accurately record a lot of information in a fraction of a second. For the most part, photographs tell the truth. However, they can be altered and photographers can leave important information out of the photographs. Since it uses pictures, photography is a universal language that can overcome many communication barriers.

Photography is a tool that can be used for a variety of application. These applications include:

- communication
- image processing
- record keeping
- research
- artistic expression

As a communication tool, photography can be used to transmit information from one person to another. The person sending the message can be anyone, a manufacturer, a salesperson, a teacher, or a journalist. Automobile manufacturers use photography to show people what their new cars look like. Salespeople use photographs and slides to make sales presentations to prospective customers. Educators use photographs, slides, and films to present new information to their students. And, journalists use photographs to tell us about the latest events.

Photography is often used to process images during manufacturing processes. Graphic arts companies use photography to make printing plates for lithography (offset) printing presses. Electronic component manufacturers use photography to make circuit boards and integrated circuits.

Photography can be used to store information. The information on a sheet of paper can be reduced to an image about 1/4 of an inch using microfilm technology. Hundreds of pages can be stored on a single microfilm card called microfiche. Libraries often store old newspapers, magazines, and other documents on microfiche. Large companies and government agencies often store their records on microfiche.

Information can also be stored in the form of photographs. Police departments use photographs to document crime scenes and accidents. Race officials capture the moment the winner crosses the finish line on film in the event of a tie.

As a research tool, photography can often be used to see things that are not visible to the human eye. For example, x-rays use energy to record information on a special type of film. X-ray technology allows physicians, scientists, and engineers to see inside solid objects. For example, when nuclear reactors are being constructed, important joints are often x-rayed to identify welding defects. Doctors use x-rays to diagnose health problems.

Infrared photography records information that is in the form of heat. energy auditors use infrared photography to measure heat escaping from buildings. Safety inspectors use infrared photographs to measure the pollution being emitted into the environment from smoke stacks. Geologists use infrared satellite pictures to find oil deposits.

Photography can be used to study motion. Scientists use high speed photography to study a variety of moving subjects. These subjects could include a bird in flight, a bullet striking a materials, or an athlete throwing a baseball. Efficiency experts use photography during time and motion studies to analyze the movement of people and materials in a manufacturing plant. Engineers use photography to study how an automobile design absorbs energy during a collision.

Artists use photography to express their ideas. By photographing objects and events in creative ways, the photographer/artist can make an artistic statement. Through the use of lighting, color, and composition, the artist can enhance the beauty or mood of a subject.

Problem Statement

Industry uses photography to make sales, training, and public relation presentations. The purpose of a sales presentation is to convince a possible customer to purchase a product. Public relations presentations provide formation about an organization. Training presentations are designed to teach employees how to perform a task or how something works. During the following lab activity, your group will be planning a training presentation.

Activity Procedures

1. After being divided into groups, the first step in planning your presentation is to select a topic for your photography project. Discuss options listed below and circle the topic your group would like to use for your photography project. If your group identifies a topic that is not on the list, write it in the blank next to "other." Ask your teacher to approve the new topic before you go on to step number 2.

One group will develop a photographic presentation describing how to:

- build a model rocket
- fix a flat tire on a bicycle
- change the spark plug on a small engine
- load film into a camera
- use the school video recorder
- format a computer diskette
- use the drill press
- make a paper airplane
- silk screen an image onto a T-shirt
- make a pinhole camera
- use a product your class manufactured
- boot a diskette in a computer
- mold expandable polystyrene beads
- make a plastic coin holder with plastisol
- make a coin or citrus cell
- make a solar hot dog cooker
- use pop rivets
- make a plexiglass picture frame
- other

2. Once you have selected a topic, you need to identify the content for a photography project. List the basic steps for your how-to-do-it process in the spaces provided below.

Step 1 _____

Step 2 _____

Step 3 _____

Step 4 _____

Step 5 _____

Step 6 _____

Step 7 _____

Step 8 _____

Step 9 _____

Step 10 _____

3. The next step is to develop a story board for your photographic presentation. A story board provides a plan for taking photographs. Professional photographers take photographs to communicate specific information. Before you can take photographs, you need to know what you want to communicate. Using the steps listed above,

develop a script for your presentation. Your script should include a title, an introduction, the steps listed above, and a closing credit (see SH #1-3 for a sample story board). Write your script in the spaces provided on your story board (SH #4-7).

4. Lastly, you need to plan the photographs you will be taking to compliment your script. Review your script and decide what should be photographed to communicate each idea. Draw a sketch of what you want to be in each photograph in the boxes next to your script (see SH #1-3). Try to use a variety of pictures to communicate your ideas. For example, include pictures of people as well as objects. Include close-ups, photograph text for your introductory title and closing credit.

Activity Analysis

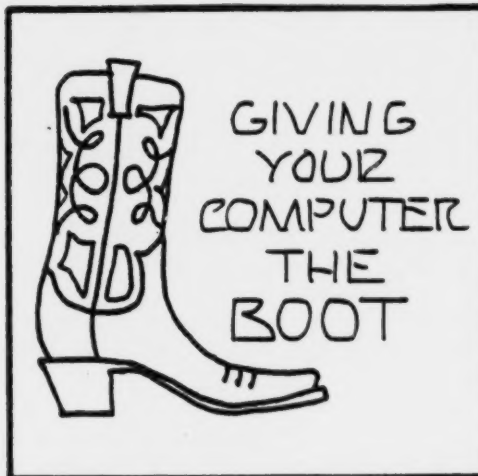
1. Identify three advantages of photographs.

2. List five basic applications for photographs.

3. What impact has photographs made on our society?

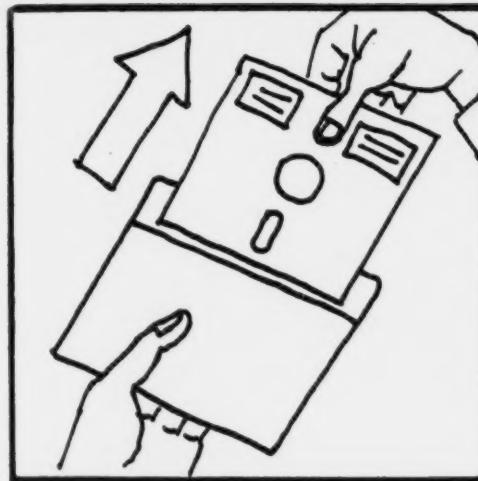
INTRODUCTION

GIVING YOUR
COMPUTER THE
BOOT



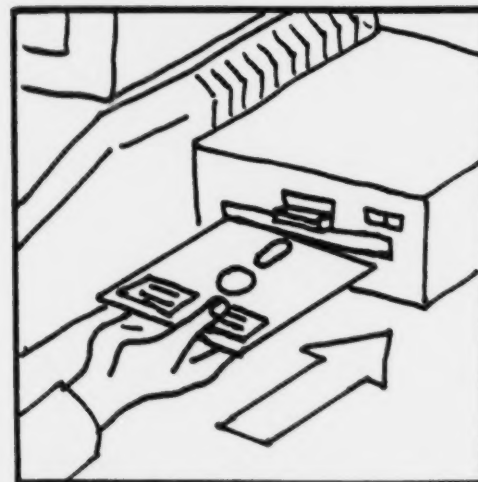
STEP 1

REMOVE THE
PROGRAM DISK
FROM ITS
PROTECTIVE
ENVELOPE.



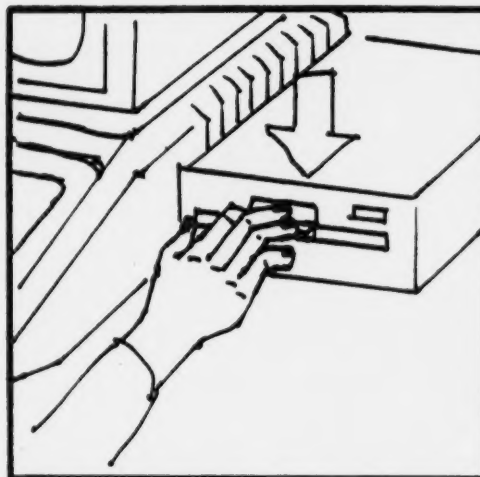
STEP 2

OPEN THE DISK
DRIVE DOOR.
HOLD THE DISK
WITH THE LABEL
FACE-UP. INSERT
THE DISK INTO
THE DISK DRIVE.

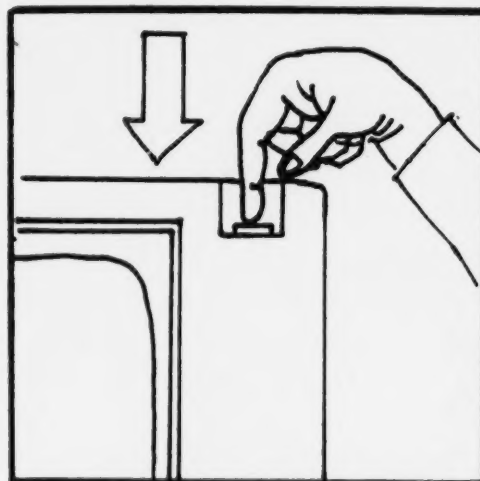


STEP 3

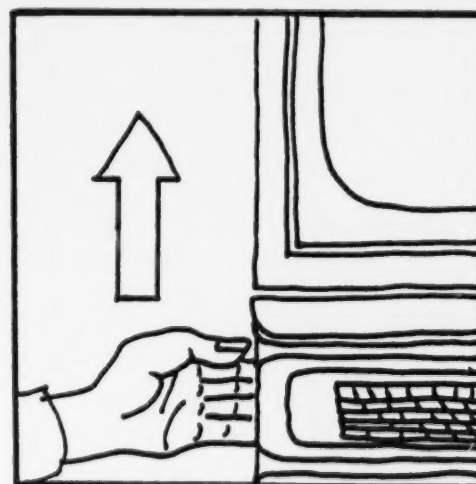
CLOSE THE
DISK DRIVE
DOOR.

STEP 4

TURN THE
MONITOR
ON.

STEP 5

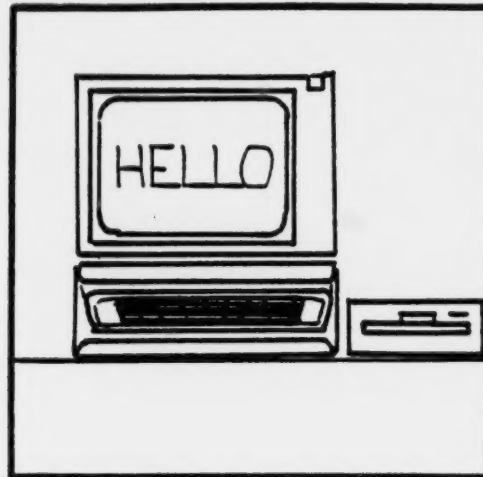
REACH AROUND
THE LEFT REAR
CORNER OF THE
THE COMPUTER
AND PUSH THE
TOP HALF OF
THE ROCKER
SWITCH.



11-P

STEP 6

AFTER YOU HAVE
TURNED ON THE
COMPUTER, THE
DISK DRIVE LIGHT
WILL LIGHT.
WATCH THE
MONITOR AND
WAIT FOR THE
HELLO MESSAGE.

STEP 7

WHEN THE DISK
DRIVE STOPS,
YOU CAN START
COMPUTING.
FOLLOW THE
INSTRUCTIONS
DISPLAYED ON
THE SCREEN.

CLOSING CREDITS

THIS HAS BEEN
A PHOTOCOMM
PRODUCTION. PHOTO-
GRAPHY AND AUDIO
BY:

TOM SMITH
KIM BROWN
MIKE JONES

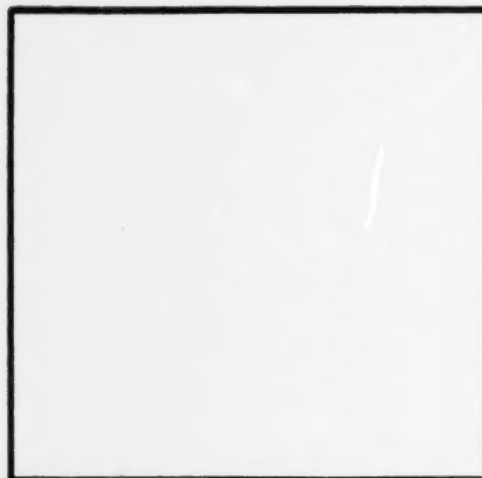
A PHOTOCOMM
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AND
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TOM SMITH
KIM BROWN
MIKE JONES

INTRODUCTION

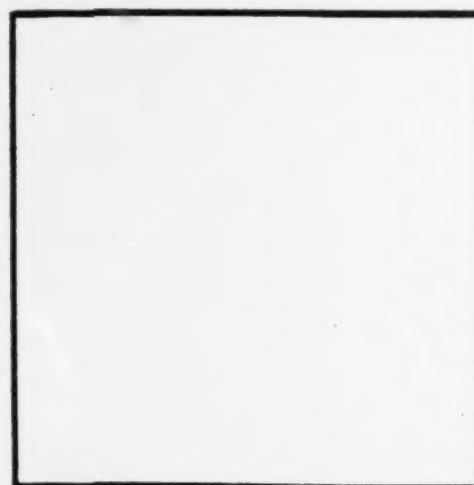
STEP ONE

STEP TWO

STEP THREE

STEP FOUR

STEP FIVE

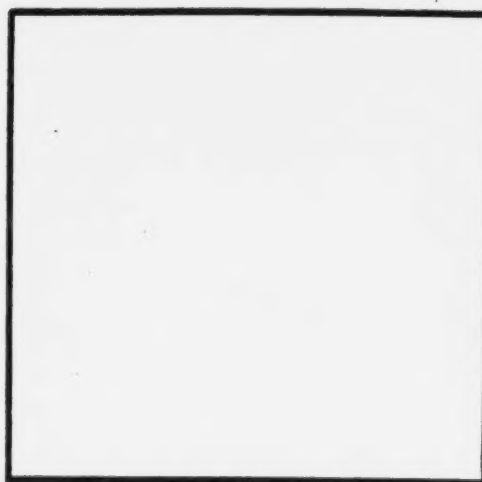


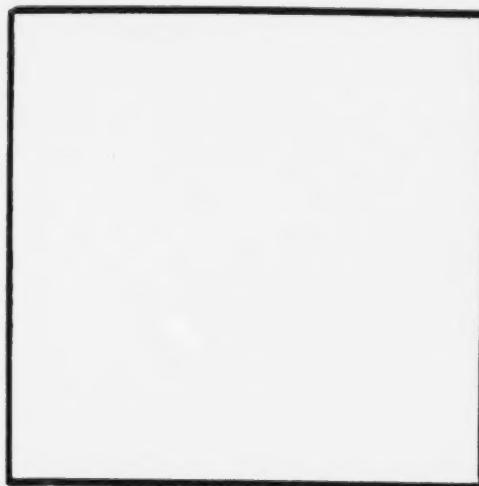
STEP SIX

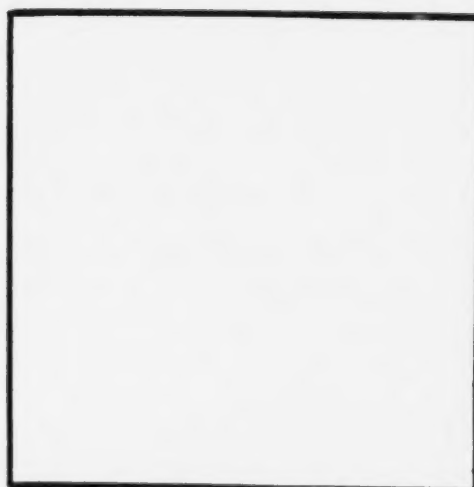
STEP SEVEN

STEP EIGHT

STEP NINE

STEP TEN

CLOSING CREDITS

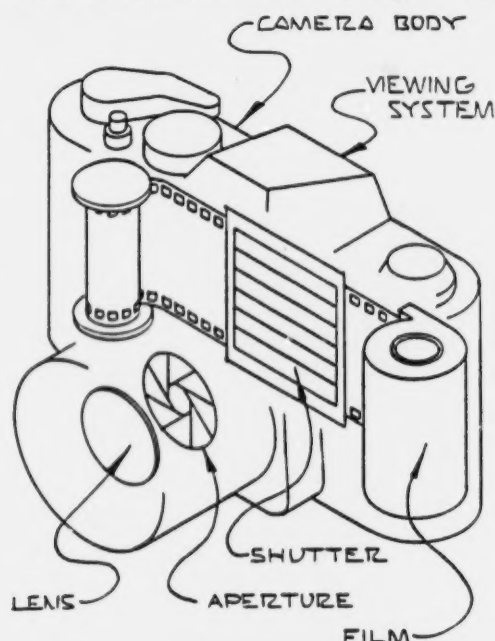


PHOTOGRAPHING THE SUBJECT

Introduction

To take a photograph, you need a camera. Even though there are a lot of different kinds of cameras, they all use the same six elements to record images. These six basic elements are:

- camera body
- film
- lens
- aperture
- shutter
- viewing system



The camera body, the part you hold when taking a picture, is basically a light proof box that houses the other camera elements. The lens, shutter, aperture and viewing system are all fastened to the camera body. In addition to providing the main structure for the camera, it also protects the film from damage, dirt, and unwanted light.

The light sensitive material used to record information is called film. Without film, a camera is a useless piece of technology. When you take a picture, the light being reflected off the subject enters the camera and strikes the film for a fraction of a second. During that fraction of a second, the light changes the chemical on the surface of the film. These changes form an image on the film that represents the subject being photographed.

The film used in most cameras has three common layers, the base, emulsion, and antihalation backing. The base is a clear plastic material that supports the emulsion layer. The emulsion layer is the part of the film that records the image. This layer contains millions of light sensitive crystals supported in a gelatin substance. When these crystals are exposed to light, they permanently change. The antihalation layer absorbs the light that passes through the emulsion and the base.

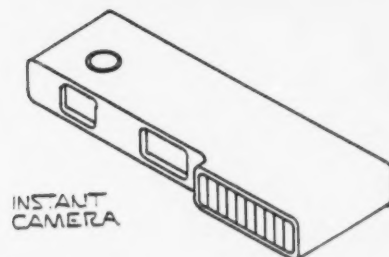
The lens on a camera focuses the light entering the camera onto the film. On adjustable cameras, the lens can be moved back and forth so close objects, as well as distant ones can be photographed.

The opening that allows light into the camera is called the aperture. It controls the amount of light that can enter the camera body and strike the film.

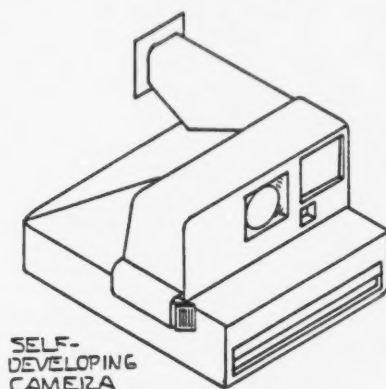
The door that opens for a fraction of a second to allow light into the camera is called the shutter. It controls how long the light can strike the film.

The viewing system is used to aim the camera at the subject being photographed. It outlines what the camera sees and what will be recorded on film.

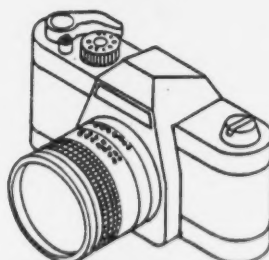
There are four basic types of cameras, instamatic, self-developing, adjustable, and automatic. Instamatic cameras are very simple and inexpensive. They are very easy to use because they typically do not have any adjustments. You just point the camera at the subject and push a button. They are often used to take snapshots.



Self-developing cameras use film that develops itself and are commonly used to produce photographs for driver's licences, student identification cards, passports, or other instances when it is important to have a picture right away.

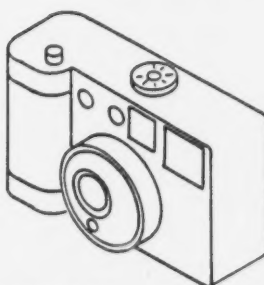


Professional and serious photographers use very sophisticated (technologically advanced) cameras. They often need to take pictures in difficult conditions or, they want to achieve special effects when they photograph a subject. To take the best pictures possible, they often use adjustable cameras. With an adjustable camera, the photographer can control how much light strikes the film and how long the film is exposed to the light. Adjustable cameras are difficult to use and require a lot of practice before one can take pictures efficiently.



ADJUSTABLE CAMERA

Automatic cameras are a lot like adjustable cameras. The primary difference is the adjustments are made automatically by an electronic system built into the camera. On some cameras, the automatic system can be turned off if the photographer wants to control the exposure. Automatic cameras are usually very expensive. However, with their automatic features, they can be as easy to use as instamatic cameras.



AUTOMATIC CAMERA

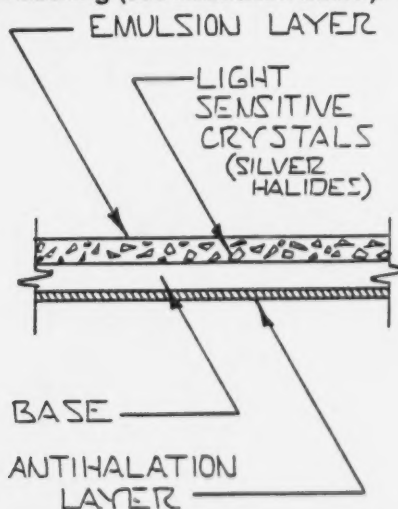
The five basic types of film are print, slide, instant, and infrared. Print film produces negatives that are used to print photographs. Depending on the type of film used, the prints can be black and white or color. Because the information is stored on a negative, the final picture can be almost any size you want. In addition, you can make as many prints of the same picture as you want.

Slide film is used to produce positives that are often called transparencies. If you hold a slide up to the light, you can see the image you photographed. Slides are viewed with a projector which shines a light through the slide and the image is then projected on a screen. Slides are often used when photographs need to be shown to a lot of people at once.

Instant film is used in self-developing cameras. The film does not have to be sent to the lab for processing because chemicals needed for processing are built into the film. After the picture has been taken, the exposed film is ejected from the camera body and the recorded image slowly appears on the film, typically fully developed in about a minute. The size of the final print is limited by the size of the camera and film. If you need several prints of the same subject, you have to take several pictures. Lastly, instant film is very expensive to use.

Infrared is sensitive to a range of light which people can not see. It records an image based on the energy being radiated by the subject. The colors of the objects in the picture depends on the amount of energy being radiated by the object. Live objects tend to be colorful, while dead objects tend to be dull. In addition, the colors in the picture may not be the same as the colors we see.

All cameras share the same five basic elements. They use a camera body, film, a lens, an aperture, a shutter, and a viewing system to record images. The four basic types of cameras are instamatic, self-developing, adjustable, and automatic. Film has three main elements: an emulsion layer, a base, and an antihalation backing (see illustration below). Four basic types of film are print, slide, instant, and infrared.



Materials and Supplies

- camera (i.e., disc, 110 instamatic, 35 mm) NOTE: Avoid cameras requiring a lot of adjustment
- film (slide or print) NOTE: Consider using 400 ASA because it works well with low light
- large sheets of light colored paper
- broad tip markers
- OPTIONAL: camera tripod

Problem Statement

Your photographic project has to be carefully planned. You have been introduced to the technologies used to take photographs. It is now time to photograph your subject.

Taking snapshots is fun because you simply point the camera and push the button. You do not really think about what the final picture will look like when you take snapshots. You simply want to capture the moments on film. Unfortunately, snapshots rarely look like or communicate as well as professional photographs.

Photographs are carefully planned. Professional photographers have specific objectives in mind when they take photographs. To create the best possible pictures, they study the subject from a variety of angles and arrange the elements to be photographed so they are pleasing to the eye. Lastly, the photographer will carefully position the center of interest in the view finder before pushing the button. During the following lab activities, you will be designing subjects, adjusting the camera, composing photographs, and taking photographs.

Activity Procedures

1. Before you can take photographs, you must prepare your camera. The film must be loaded into the camera and needed adjustments must be made. Prepare your camera according to the instructions provided by your instructor.
2. The next step is to prepare the subject you will be photographing. Start with the first panel on your story board. Review the script and study your sketch. Prepare the people and/or props needed to create an introduction for the photographic presentation. Arrange the people and/or props so they will make a nice photograph. Do not be afraid to experiment. You may need to try several arrangements before you discover the best one for the photograph.
3. Before you photograph your subject, you need to compose the picture. Composing the picture means arranging the elements in the picture so they are pleasing to the eye. The first step is to identify the center of interest or the main idea in the picture. The second step is to position the center of interest in the view finder. Even though it is called the center of interest, you do not want to locate it in the center of your picture. It is typically positioned according to the rule of thirds. To use the rule of thirds, you need to imagine your picture divided into sections like a tic-tac-toe board. The center of interest can be positioned in one of the locations where the lines cross (see SH #1).

Once the picture has been composed, you can take the photograph. To take the photograph, hold the camera very still and push the button.

4. Now that you know how to prepare the subject, compose the picture, and use your camera, photograph the rest of the steps in your how-to-do-it process. Use your story board as a guide. Make sure you take photographs that will communicate the ideas in your script. Do not take snapshots. Design the subject and compose your picture before you push the button. Take turns being subjects, designing subjects, and taking photographs. When you have finished your roll of film, follow the steps provided by your instructor to remove the film from your camera. Put the exposed film in a safe container until it can be processed.

Activity Analysis

1. List and identify the roles of six basic elements in the photographic process.

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____
- f. _____

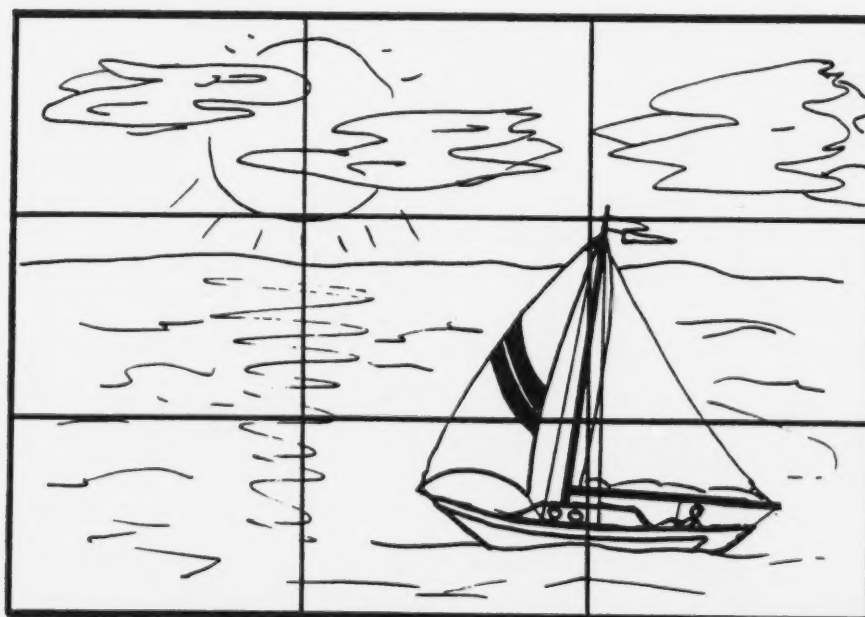
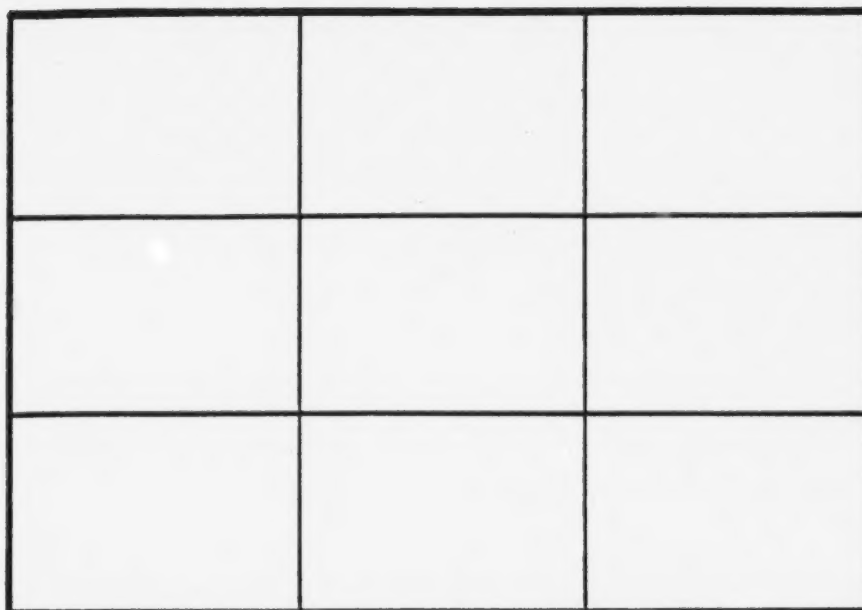
2. Identify the four basic types of cameras:

- a. _____
- b. _____
- c. _____
- d. _____

3. Identify the characteristics of each basic type of film.

4. How can photographs affect a company's advertising campaign?

SH #1



23-P

PROCESSING PHOTOGRAPHS

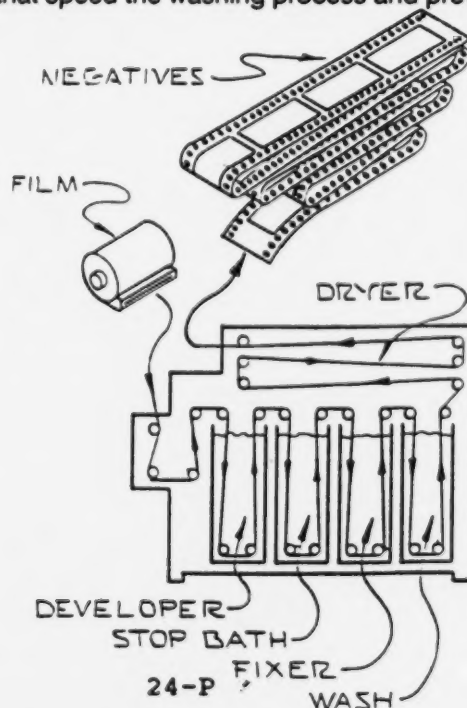
Introduction

When a roll of film is finished, most people take it to a local camera shop or drug store for processing and pick up a set of prints a day or two later. What happens between the time the film is dropped off and the time the prints are picked up is a mystery to most people.

In most cases, film is processed by a machine, and for the most part, the process is automated and standardized. You send your film in and you get back 3" x 5" or 5" x 7" color prints. However, when special prints need to be made for things like portraits and publications, the process is performed by technicians in a custom photo lab. For example, newspapers and magazines often do their own film processing in a darkroom. Processing their own film allows them to make prints that meet their specific needs.

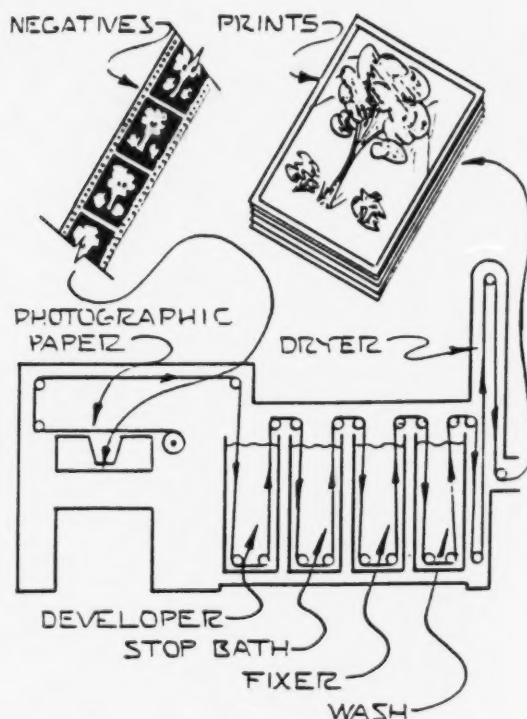
When you take print film in for processing, it is sent to a commercial lab for processing. The processing has two major steps. First, the film is developed into negatives. Second, the negatives are used to make prints. When you pick up your pictures, the prints and the negatives are in the envelope. We are usually so interested in the prints, we tend to forget about the negatives.

The developing process starts with a chemical called developer. It creates a chemical reaction that causes the exposed areas on the film to change color. To stop the developing process, the film is treated with an acid solution called stop bath. Next, the film is treated with a third chemical called fixer. The fixer dissolves the unexposed crystals on the film. The film is washed in water with additives that speed the washing process and prevent spotting. Lastly, the developed film is dried.

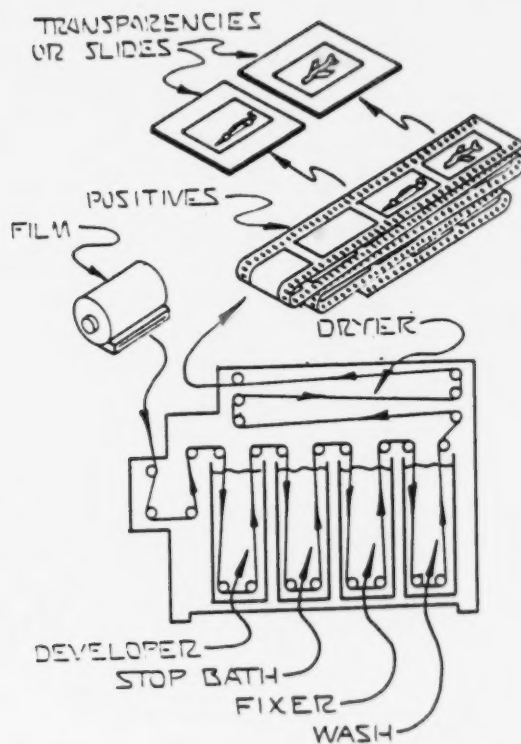


During the development process, the images stored on the film will appear in the form of negatives. They are called negatives because everything is the opposite color it was in the photographed scene. The parts of the picture that were exposed to a lot of light are darker than the areas that receive very little light. This means the color white, which reflects a lot of light, appears black on the negative. The color black, which absorbs light, is clear on the negative.

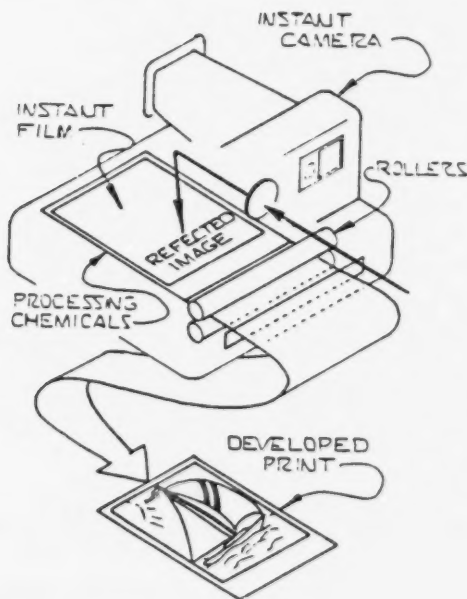
The next step is to use the negatives to make prints. The negatives are fed into a machine. The machine shines a light through the negatives and exposes a roll of photographic paper. The photographic paper is just like film, it is sensitive to light. However, dark areas on the negative block the light. Clear areas allow the light to travel through the negative and strike the paper. Therefore, areas that are black on the negative will appear white on the paper. Clear areas will appear black on the paper. After the paper has been exposed, it is developed in much the same way as film. It is treated with a developer, stop bath, and fixer. The paper is washed, dried, and cut into individual prints.



When slide film is developed, the result is a strip of positives or transparencies. If you hold the transparencies up to the light, everything looks just like it did when you took the photographs. Each transparency is mounted in a 2" x 2" paper or plastic frame. Together, the frame and the transparency make a slide. Slides are usually viewed with a projector. However, they can be used just like negatives to make prints on a special type of photographic paper.



In the case of instant film, the chemicals needed to process the film are sealed in the film. The film fully develops in about one minute and you have color prints. In some cases, the final print can be removed from the base that carried the chemicals.



Photographs are not always printed on photographic paper. Negatives are often used to print images onto other light sensitive materials during a manufacturing process. These materials are called image carriers. In the graphic arts industry, the image carrier can be a printing plate. Information is photographed, the film is developed, and the negative is used to expose a printing plate. After the printing plate is developed, it is mounted onto a printing press. The plate carries ink and transfers the image to paper. Sometimes photographs are printed onto a light sensitive material used to make stencils. Developed stencils can be used to print images onto things like T-shirts, coffee cups, and pop bottles. Lastly, the images for integrated circuits are reduced and printed on mask. The mask is used to etch the images into a silicon wafer.

During film processing, exposed film is treated with a variety of chemicals to make the stored image visible. When print film is processed, it becomes a strip of negatives. The negatives are used to expose photographic paper or other image carrying materials. When the paper is developed, the finished product is a photographic print. When slide film is processed, it becomes transparencies. Slide transparencies can be viewed with a projector or they can be used to make prints. Instant film is automatically processed after it has been exposed by the chemicals built into the film.

Materials and Supplies

Story Board Presentations

- Poster board
- Rubber cement
- 3" x 5" note cards

Slide Presentation

- Slide projector
- Screen
- 1 Cassette player per group

Activity Procedures

Most people do not process their own film. Even professional photographers rely heavily upon commercial laboratories for film processing. However, a film processing lab does not do all the work needed to prepare a photographic presentation. Once the film has been processed, the presentation team needs to review all the photographs, identify the best ones, sequence them with the script, and assemble the presentation. During the following lab activities, you will be using your prints or slides to prepare a photographic presentation.

1. The first step in preparing your presentation is to identify the photographs you will use. Organize the photographs so they coincide with your story board. Review the possible photographs for the first panel on the board and select the one that best communicates the idea you wish to convey. Next, select the best photograph for the second panel, and continue this process until you have chosen a photograph for each panel.

2. The next step is to prepare the script for the presentation. This activity can be done one of two ways: story board demonstration or slide presentation. If your presentation will be in the form of a story board, print the script for each photograph onto a 3" x 5" card. If your presentation will be in the form of a slide presentation, you could read the script from the 3" x 5" cards or you could record it on a cassette tape. If you record your script, use a clicker or bell to indicate when to go to the next slide. Make sure you speak clearly and give everyone in your group a chance to record part of the script. If you make a mistake, simply stop the tape, back up, play the tape back, and again record the bad section. Consider using music at the beginning and the end of your presentation.
3. The last step is to assemble your photographic presentation. If you are making a story board, mount your photographs and script (3" x 5" card) on poster board. Make sure your photographs are in their proper order and the script matches the photographs. If you are making a slide presentation, put your slide in order into a slide projector tray. You will probably need to put the slide in upside down and backwards for them to be projected correctly on the screen. You may need to experiment with the first few slides before you discover the correct method for loading slides. Next, turn the projector on, advance the tray so the first slide is displayed on the screen, and adjust the project so the picture is in focus. Put your cassette tape into the tape recorder and push the play button. When you hear the signal, advance to the next slide. Make sure the slides match the script. When you have finished testing your slide presentation, remove the slides and number them so you can put them back in order when it is time to make your presentation. Rewind the tape and put it back in its case. Store your story board or slide/tape presentation in a safe place.

Activity Analysis

1. Describe the process used to turn film into a negative.

2. List and describe the four basic chemicals used to process film.

- a.

- b.

- c.

- d.

3. List and describe four basic types of image carriers.

- a. _____
- b. _____
- c. _____
- d. _____

PRESENTING PHOTOGRAPHS

Introduction

Formal presentations are an important part of conducting business in industry. They are used for things like proposing new ideas, selling products, educating employees, conveying information, and keeping the general public informed. Because "a picture is worth a thousand words," the people who plan and make presentations rely heavily on photographs.

There are several different types of presentations. They are as follows:

- person-to-person
- small group
- large group

Person-to-person presentations tend to be informal and flexible since both parties participate in the exchange of information. They must allow the presenter to skip over or dwell on specific information according to the needs of the receiver. This type of presentation can be in the form of a story board or a slide presentation. A slide presentation to one person is often conducted with a portable desk-top projector with a built in screen. Person-to-person presentations are typically simple and to the point. They are often used to sell products and provide individualized training.

Small group presentations are often semiformal. The presenter's role is to convey information and answer questions. The audience's role is to receive the information and ask questions. Presentations of this kind are typically given in small conference rooms or classrooms. Story boards can be used when there are only a few people in the audience. Slide presentations using projectors and screens are more appropriate for larger groups. This type of presentation can be used to propose ideas, sell a product, or convey information.

Large group presentations are very formal. Because the group is large, the audience can not participate in the presentation. Therefore, most large group presentations are one-way. The presenter presents information while the members of the audience watch and listen. This type of presentation is typically conducted in a large conference room, banquet hall, theater, or auditorium. This type of presentation often requires sophisticated presentation equipment that might include large screens, multiple projectors, and amplified sound systems. The primary goal of a large group presentation is to inform the audience.

Professional presenters follow a basic series of steps when they make a presentation. They are as follows:

- practice the presentation
- promote the presentation
- prepare the presentation
- make the presentation
- clean-up
- evaluate and modify the presentation

The first and possibly most important step in the presentation process is to practice the presentation. Professional presenters will often make their presentation to friends several times before they present it to the real audience. When the rehearsal is over, they ask their friends for ideas to make the presentation better.

The next step is to announce and promote the presentation. The best presentation in the world is useless if no one shows up to see it. Therefore, it is important to make sure your target audience knows you will be making the presentation. Salespeople often call their customers before they make a sales presentation. In industry, memos are read in meetings to announce a presentation. Large conferences typically include a program that lists presentation topics, times, and locations. Sometimes, flyers are printed and mailed to announce important presentations.

Preparing the actual presentation can include things like setting up the projector and screen, arranging chairs, and checking the lighting. In addition, developing a positive attitude and dressing appropriately are also important parts of preparing for a presentation.

The ultimate step is actually making the presentation. This is the step for which presenters plan and work so hard. Most of the time, if the planning is good, the presentation will be also be good. To make a good presentation, you need to be able to do more than take good pictures. You need to speak clearly, make eye contact with your audience, and use simple gestures.

When it is all over, the presenter needs to clean up. Clean up can be as important as the setup, especially if the presentation needs to be given again in the near future. A poor clean up can create more work the next time the presentation needs to be made.

Lastly, after the presentation has been made, it needs to be evaluated. Problems need to be identified and improvements need to be made. Even though there is always room for improvement, it is important not to make big changes in a good presentation.

Problem Statement

Photographs can be powerful communication tools when making a presentation. There are three basic types of presentations, person-to-person, small group, and large group presentations. The basic process for making a presentation includes practicing, promoting, preparing, presenting, cleaning up, evaluating, and modifying.

Materials and Supplies

- SH #1
- Slide projector (if students are making a slide presentation)
- Screen
- Cassette
- OPTIONAL: A video tape camera used to record the presentation

Activity Procedures

1. Use SH #1 to evaluate each presentation.
2. Your group has worked hard to prepare photographs and a script. Finally, it is now time to give your how-to-do-it presentation.
3. In your group, decide who is going to perform certain tasks during your presentation. For example, who is going to set up the projector, who is going to introduce the presentation, who is going to turn the lights on and off, who is going to run the projector, and who is going to answer questions.
4. If your presentation is in the form of a story board, consider dividing your presentation into sections. Have each member of your team present one section of the story board. For example, if your team has three members and your story board has 12 parts (photographs and script card), each member could present four parts. Another option would be to have one member introduce the presentation, another member give the presentation, and another member answer questions.
5. Once you have assigned all the tasks, conduct a rehearsal. If you discover new tasks that have to be performed, assign them to members of the team. During your rehearsal, check the equipment to make sure it is working properly. During your introduction, make sure the presentation topic and the members of the presentation team are introduced. Make sure your photographs are in the proper order. Take turns asking and answering questions.
6. When it is your turn to give your presentation, stand up straight, speak clearly, and make eye contact with your audience. When your presentation is over, remove and pack the materials. While you are cleaning up, your peers will evaluate your presentation. Your teacher will give you a summary of the evaluations. Use the summary to improve your presentation so it will be even better the next time you need to give it. Good luck.

Activity Analysis

1. List and describe the three types of presentations.

a. _____

b. _____

c. _____

2. Describe how to make a presentation.

PHOTOGRAPHIC PRESENTATION PEER EVALUATION FORM

Presentation Topic: _____

Team Members: _____

Directions:

After each product presentation, rate the presentation elements listed on the left, on a scale of one to five.

1 very good 2 poor 3 average 4 good 5 excellent

The photographs:

were in a logical order 1 2 3 4 5

communicated the ideas in the script 1 2 3 4 5

were well composed (pleasing to the eye) 1 2 3 4 5

The script:

followed a step-by-step process 1 2 3 4 5

provided important information 1 2 3 4 5

The presenters:

introduced the topic 1 2 3 4 5

introduced themselves 1 2 3 4 5

spoke clearly 1 2 3 4 5

made eye contact 1 2 3 4 5

were able to answer questions 1 2 3 4 5

conducted their presentation smoothly 1 2 3 4 5

PHOTOGRAMS

SUPPLEMENTARY PHOTOGRAPHY ACTIVITY

Introduction

A simple definition for photogram is a drawing made with light. Photograms can be the final product in photography, or can communicate ideas that would take thousands of words to describe. People have always said, "a picture is worth a thousand words."

The exact process that takes place on a light-sensitive film when it is "exposed" to light varies according to the exact nature of the material being used. In the case of black and white film, the photons of light cause silver ions in the emulsion layer of the film to separate from bromide ions and form clumps of pure silver. This silver turns black when developed, causing the film to become a "negative".

Color film, on the other hand, has several emulsion layers, three of which are sensitive to different wavelengths of light. The chemicals in the emulsions react to light by turning into three different dyes when developed, but they are seen as one color. Depending on the chemicals used, the film may develop as a positive or as a negative. The first commercial color film, Kodachrome, which made positive "slides," was introduced in 1935. In 1941, Kodacolor was introduced for making color negatives.

Blueprinting and whiteprinting use chemicals in a paper coating that are sensitive to light. In blueprinting, the exposed chemical turns blue when developed. This is a tone reversal or negative. Whiteprinting works in the opposite way. The paper exposed to light develops white, while the unexposed areas convert to a dye. Both methods are used primarily for copying architectural drawings.

Light sensitive material such as photographic film and paper is rated according to the amount of light it takes to expose it. The American Standards Association (ASA) is the group responsible for the different speed ratings for film. ASA cooperates with the International Standards Organization (ISO), and many films list an ISO number instead of an ASA number. ASA and ISO numbers are the same for a given film. A low number film (ASA or ISO 125) is used when there is a bright light, while a high number (ASA or ISO 400) is used when there is very little light. The 400 film is a "faster" film than the 125 film because when used in the same light intensity, the 400 film must be exposed for a shorter time than the 125 film. Photosensitive materials are used by photographers to express themselves. It is the material used when copying architectural drawings and land plots. Moving pictures and video tapes also begin as light-sensitive materials.

This Technology Education Activity will provide you with the basic understanding needed to make an image, using light sensitive paper.

Materials and Supplies

- 18" x 24" blue print paper
- developing tube (on commercial blueline printer)
- transparent material, e.g., clear glass, clear Plexiglas
- translucent material, e.g., colored glass, frosted glass, colored Plexiglas, colored triangles.
- opaque pattern material, e.g., pliers, tri-square, punch, etc.
- one completed photogram

OPTIONAL: Materials for Developer (DR #1 and 2)

- 4" PVC pipe, 18" long
- 4" cap to enclose the developer
- 2" PVC pipe, 18" long
- 2 2" elbows
- 1 threaded cap

Problem Statement

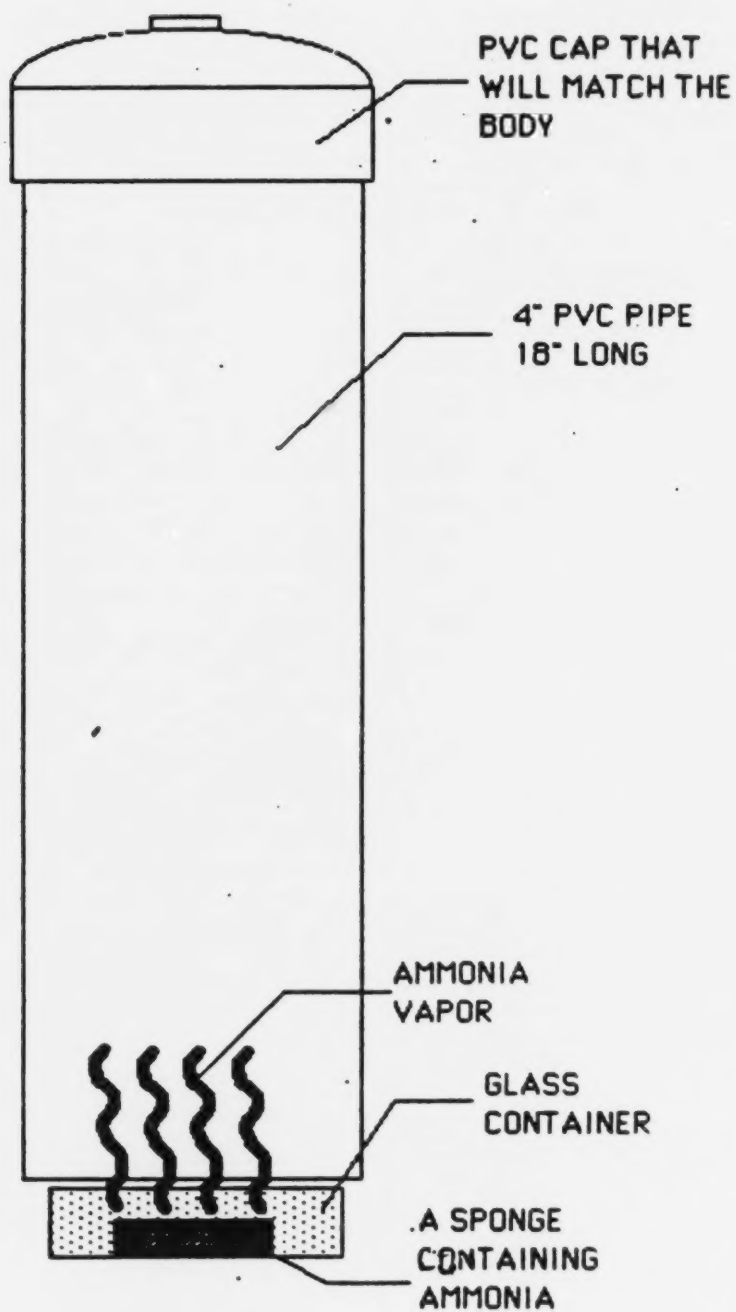
1. Preparation and printing a simple photogram
 - A. Review all information given to you by your instructor.
 - B. Locate objects you would like to use on your print
 1. one opaque item
 2. one transparent item
 3. one translucent item
 - C. Obtain a piece of light sensitive paper from your instructor. **Be sure to keep yellow side covered until you are ready to make the photogram.**
 - D. Set the paper so that the yellow side is up.
 - E. Arrange objects on a piece of light sensitive paper under classroom lights (once objects are in place, do not move them as this will cause a shadow on your final print).
 - F. Allow objects to be exposed under lights for approximately 30 - 40 minutes.
2. Developing your photogram
 - A. After objects have been exposed to classroom light, place the paper in the developing tank (instructor will have this prepared for you).
 - B. Carefully watch your print develop as the paper reacts to the ammonia fumes and areas of your print begin to show.
 - C. Remove print when a dark image appears. Remember, ammonia fumes can be harmful. Do not use tank in a small, contained area. **Use in an area that is well ventilated, and refrain from breathing fumes for a long period of time.**

Activity Analysis

Directions: Circle the T for true and the F for a false statement. Read the question carefully before you make any decision.

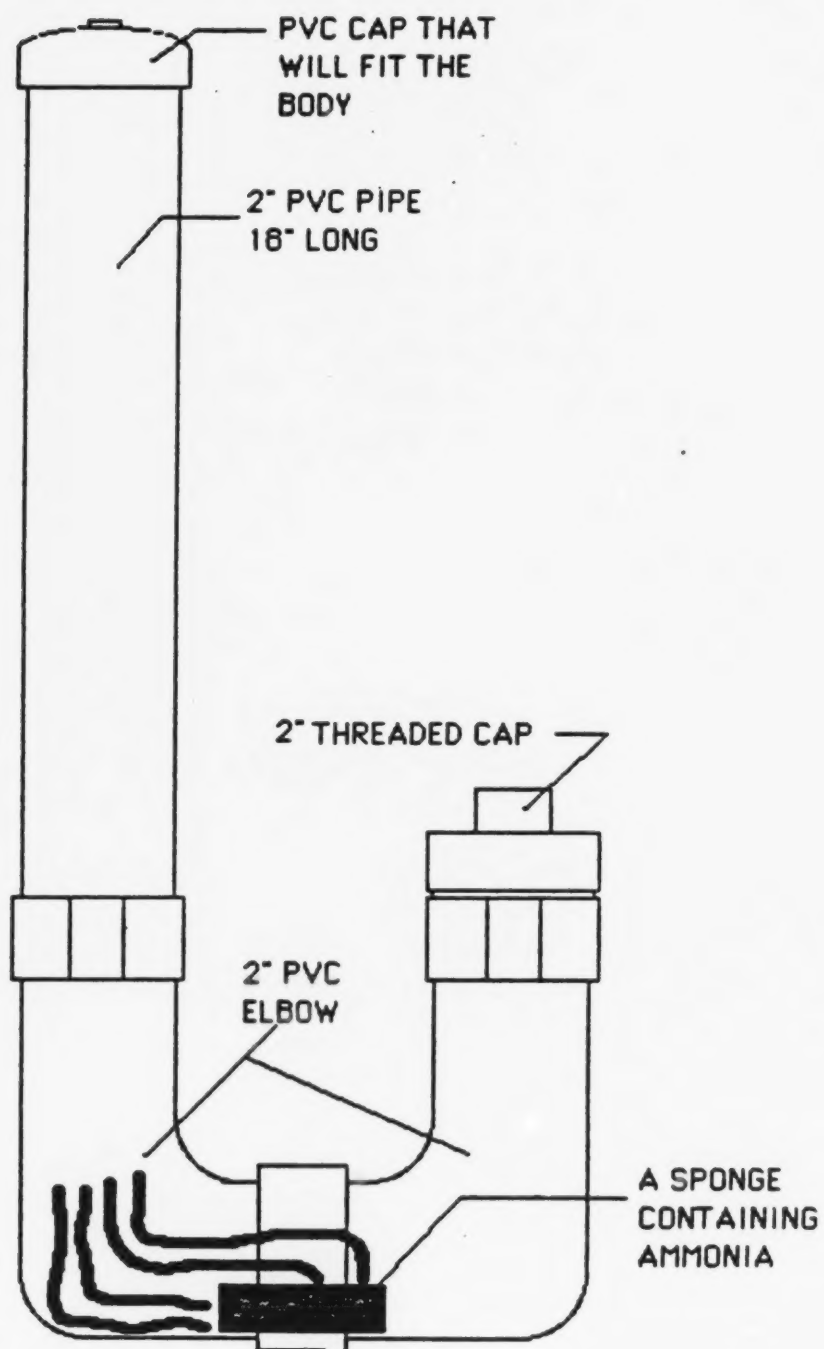
- | | | | |
|----|---|----|--|
| T | F | 1. | Light sensitive paper is similar to what we call film. |
| T | F | 2. | A simple definition of photogram is "drawing with light". |
| T | F | 3. | An opaque item allows light to pass through it thus creating an image. |
| T | F | 4. | Distance from a light and the intensity of the light will determine the length of time needed to develop the light sensitive material. |
| T | F | 5. | ASA and ISO are the groups responsible for determining standards for speeds of film. |
| T | F | 6. | ASA 400 is used when a person has a lot of light available when taking pictures. |
| T | F | 7. | A transparent item allows all light to pass through, thus creating a light image on your light sensitive paper. |
| 8. | | | How are images created with light sensitive material impacting our society? |
-
-

PHOTOGRAM DEVELOPER



38-P

ENCLOSED PHOTOGRAM DEVELOPER



39-P

GRAPHIC ARTS

GRAPHIC ARTS

Suggested Learning Objectives

Upon completion of the graphic arts unit, students will be able to:

- A. Define and properly use common graphic arts **terminology** like lithography, paste-up, compose, point, fonts and electrostatic typeface.
- B. Identify basic **applications** for graphic arts technology including artistic expression, recording information, communicating ideas, disseminating news, and advertising products.
- C. Describe the societal and environmental **impacts** associated with graphic arts technology including facilitating communication between people and organizations, utilization of natural resources, visual pollution, and aesthetic expression. SC2
- D. Describe the equipment, techniques, and **applications** for common duplication technologies including relief, screen, gravure, planographic, electrostatic, and photographic.
- E. Identify basic natural, human, material, financial, technological and information **resources** used in graphic arts enterprises (e.g., paper, graphic designers, duplication equipment).
- F. Describe the major milestones in the **history** and evolution of graphic arts technology including the invention of paper and movable type, the introduction of lithography and electrostatic printing processes, and integration of photographic techniques, and the development of electronic typesetting and publishing technologies. SS2
- G. Describe basic graphic arts **processes** like typesetting, formatting, composing, illustrating, stripping, photographing, registering, duplicating, binding, and finishing.
- H. Identify potential **safety** hazards, establish guidelines for safe behavior, and adhere to common safety practices when around or participating in graphic arts activities. PH3
- I. Identify, describe, and evaluate **career** opportunities in the graphic arts industry (e.g., typesetter, press operator, graphic designer, publisher) based on their interests, talents, and career expectations.
- J. Apply basic mathematical concepts to do things like measure copy and materials as well as estimate production costs. MA1
- K. Use basic graphic design techniques to identify, select, combine, refine, and present potential graphic products that address a given communication problem.

- L. Evaluate and design graphic products based on the basic rule of composition including balance, unity, rhythm, proportion, and contrast. FA1
- M. Determine the best printing technique based on material, quantity, cost, quality, audience, and equipment considerations
- N. Apply the basic communication model to graphic arts media including newspapers, billboards, magazines, and brochures. LA1
- O. Forecast the effects of electronic publishing technology on things like employment patterns, printing costs, and product quality. SC2
- P. Select the optimum means for communication for addressing a specific communication problem based on material, content, audience, dissemination, design, cost, and quality control considerations.
- Q. Use common graphic arts tools, materials, equipment, and machines to design and duplicate a simple graphic product that addresses a given communication problem.
- R. Use graphic arts techniques to transmit messages accurately and in good taste.

Suggested Learning Activities

1. Introduce students to a variety of graphic arts enterprises. Discuss the products they produce and how they are organized. Include newspaper companies, book publishers, printing houses, and job shops in your discussion. Divide the class into small groups. Have each group create, name, and organize a graphic arts company by designing a logo, selecting jobs, and/or completing an organization chart. Ask students to identify and discuss the various roles played by graphic communication companies in our society. Have students discuss the power associated with access to graphic communication technology.
2. Explain how people and organizations use graphic products to communicate messages to an audience. Have each group identify a message that needs to be transmitted to a given audience. Possible messages could center around announcing an upcoming event, promoting an organization, expressing an opinion, describing a program, educating people about a topic, or persuading people to purchase a product. Have students discuss the ethical issues associated with using print media to influence people.
3. Introduce students to the basic types of graphic products used to transmit messages. Include things like newsletters, packaging, T-shirts, brochures, posters, books, and magazines. Explain how the type of graphic produced depends on the message being transmitted. Have each group evaluate and select the best graphic product for transmitting their message based on audience, material, equipment, cost, quality control, and production considerations. Have students identify and discuss the positive and negative effects using of bill boards, junk mail, and newspapers to transmit messages.
4. Introduce students to the concept of composition. Show students how things like

color, typeface, contrast, rhythm, balance, proportion, and unit are used to make graphic products functional and attractive. Show students a variety of graphic products and have them identify examples that use formal and informal balance, vertical and horizontal positioning, screen tints, the golden line of proportion, and/or reverse lettering. Require students to use one or more of the basic composition techniques during the following learning activity. Ask students to identify graphic products that have good and poor composition.

5. Explain how graphic designers create, evaluate, select, and refine designs for graphic products. Using brainstorming techniques, have each group generate a variety of design ideas for their graphic product. Require students to record each idea in the form of a thumbnail sketch. When they have finished, have each group evaluate, select, and combine their best design ideas into one rough layout for their graphic product. Ask students to explain why it is important to accept everyone's ideas during a brainstorming session. Discuss the consequence of a poor design.
6. Discuss how various graphic arts companies gather information and compose messages for graphic products. Have each group gather information about the topic being featured on their graphic product. If appropriate, include elements that address who, what, where, when, how, and why. Use the information gathered to write the messages that will be featured on their graphic product. Require students to develop outlines, write a rough draft, edit the draft, and proof read the final copy. Ask students to explain the importance of truth and accuracy when preparing and presenting information through print media.
7. Discuss how illustrations complement and enhance written messages. Using clip art, photographs, computer generated art, and/or original art, have students illustrate the messages for their graphic products. Discuss the ethical considerations that must be addressed when evaluating, selecting, and using illustrations for graphic products. Have students explain when an illustration is in bad taste.
8. Demonstrate and discuss how designs for graphic products are prepared for duplication. Using traditional or computer-aided graphic arts tools and techniques, have each group prepare a mechanical layout for their graphic product. Include tasks like drafting the layout, cropping and positioning illustrations, composing and positioning copy, and preparing camera ready copy. Ask students to forecast how electronic publishing technology will change how people and organizations communicate.
9. Introduce students to the techniques used to print graphic products. Include relief, electrostatic, photographic, screen, planographic, and gravure techniques in your discussion. Discuss the advantages, disadvantages, and application of each printing process. Have each group evaluate and select the best printing techniques for their graphic product based on material, quality control, cost, equipment, and production considerations. Ask students to determine the best printing technology for a variety of graphic products (e.g., pop cans, movie posters, bill boards, automobile brochures).
10. Introduce students to the concept of an image carrier. Demonstrate how to prepare silk screens, compose type, and/or make offset-lithography plates. Using laboratory tools, equipment, and materials, have each group prepare an image carrier for reproducing

their graphic product. Include processes like mounting screens, preparing and adhering stencils, and exposing and developing plates. Ask students to identify the consequences of not following established procedures when preparing an image carrier.

11. Demonstrate how to use the tools, equipment and/or machines needed to duplicate each group's graphic product. Emphasize the safety considerations associated with operating various types of printing equipment. Using laboratory printing equipment and machines, have each group reproduce their graphic product. Include processes like preparing ink, feeding or registering paper, and operating and cleaning equipment. Have students discuss the impact of automated printing processes and equipment on things like product quality, company profit, and employment patterns.
12. Discuss how graphic products are advertised, sold, and distributed. Have each group develop and implement a simple advertising, sales, and/or distribution strategy for their graphic product. Ask students to forecast how telecommunication technologies like on-line databases, facsimile systems, and telemarketing will effect graphic communication technologies and enterprises in the future.
13. Discuss the milestones in the history and evolution of graphic arts technology. Assign each student a historical event. Using library resources, have students gather information and develop an abstract describing the people, dates, places, and impacts associated with their assigned event. Encourage students to illustrate their abstracts. Post each abstract on a large timeline. Ask students to describe how given events influenced our culture and subsequent technological developments.
14. Discuss the career opportunities in graphic arts. Include occupations at the unskilled, semiskilled, skilled, technician, and professional levels in the discussion. Using library and guidance resources, have each student gather information and present a short written or verbal report about an occupation related to graphic arts. Each report should include information about the educational requirements, working conditions, benefits, salary, and advancement potential related to the occupation. Ask each student to evaluate the career based on their interests, talents, and career expectations.

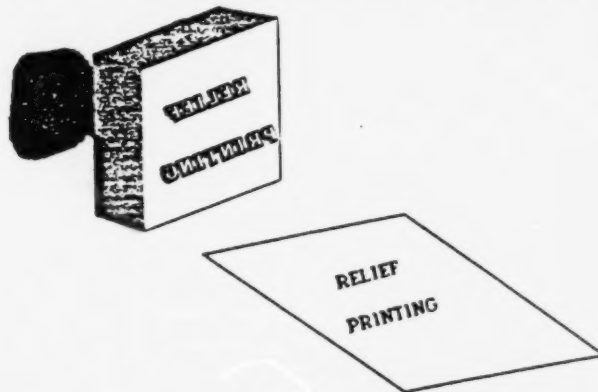
THERMAL SCREEN PRINTING

Introduction

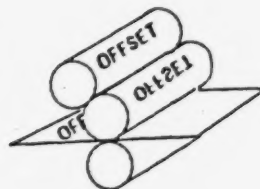
An image carrier is a material on which letters, symbols, numbers and pictures are produced for the purpose of transferring them to a product. Image carrier materials may take the form of plastic stencil, metal plates, plastic film, raised metal type, photographic paper or rubber composition plates.

The selection of the graphic process and the appropriate image carrier is determined by such factors as material to be printed, number of copies to be printed, equipment availability and money. The image carrier is determined by the graphic process used. The most frequently used graphic communication processes include: relief printing, offset lithographic printing, xerography, and screen process printing.

The image carrier for relief printing involves the printing surface, which is raised on the printing plate. The plates are usually made of metal or hard rubber. The characters are set up backward so the image will be read right when pressed against paper (see illustration below.)

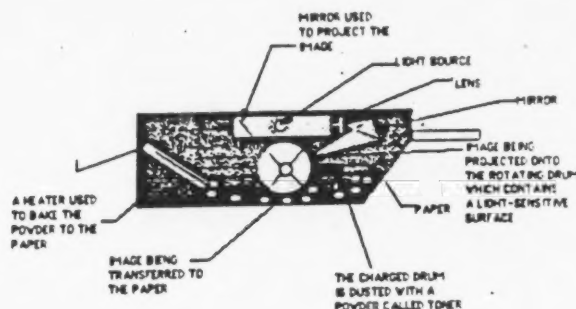


The offset lithographic image carrier consists of a printing plate, usually made of aluminum, with a flat surface. The plate is then wrapped around a cylinder. The printing surfaces of the plate are covered with a greased ink. Then, the entire plate is covered with water. The greased ink is attracted to the greased image on the image carrier and the remainder of the plate accepts only water. The inked greased image is now offset (transferred) onto a rubber blanket which in turn, transfers the image to paper passing through the press.



5-G

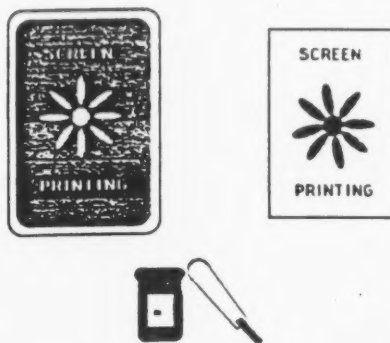
In xerography, a copy is placed on a bed of the copy machine. Electrostatic energy then attracts a special powder known as toner to the copying page. The toner is then arranged in an exact duplicate of the original and the image is transferred to the paper as it passes through the machine.



Not all graphic processes are done on paper. Screen printing is a graphic process used to place messages on bottles, cans, glass, T-shirts, and many other materials.

The screen printing process has grown in size over the past decade due to technical advances in the screen stencils and the variety of screen inks available for all purposes from billboard signs to electronic printed circuits.

The process of screen printing utilizes a screen, originally made of silk but now available in metal or polyester, a frame to hold the screen in place, screen inks, a stiff rubber blade, called a squeegee, for moving the ink over the screen, and a stencil cut or photographed into a specified shape or design.



After the cut or designed stencil is laminated onto a screen, ink is poured onto the screen and pulled across it in a scraping motion with the squeegee allowing ink to flow through the open areas of the stencil onto the material to be printed.

This Technology Education Activity will provide you with an opportunity to experience image carriers through screen printing. Each student will design, create and print a message or graphic using screen printing techniques.

Materials and Supplies

1. 8" x 10" thermal screen (NOTE: Can be obtained through several popular vendors (e.g., Pitsco, Paxton and Patterson)
2. Plastic screen mounting frame
3. Water base silk screen ink
4. Fabric binder
5. Squeegee
6. Roll double-stick screen mounting tape
7. Spatula
8. Thermofax machine
9. T-Shirt - students can bring in their own
10. 11" x 14" stiff piece of cardboard
11. Assorted clip art books

NOTE: If available, a computer and a popular graphic software package can be used to enhance the appearance of the art work.

Problem Statement

A local citizen's group is planning a "Recycling Awareness Day" in your community. The event will help show how all people can share in saving improving our environment. Local leaders have come to your company, Wear Designs, Inc., for help in the promotion of the event. The group wants you to create a design that can be sold to event participants. The design should include the name of the event, a slogan, theme or motto, and a graphic logo and illustration that reflects the theme of recycling. The graphics maps will be transferred to T-shirts using a thermal silk screening process.

Activity Procedures

Preparation of Artwork

1. Begin by preparing artwork. using graphics from a clip art book or a comuter-aided graphic program and system, prepare artwork that represents a recycling theme. Make sure they will fit along with text in an area 7" x 10." NOTE: A copy machine can be used to reduce the image.
2. Next, compose a message. Using opaque inks, stencils, or computer graphic package, create the text needed for the design.
3. Once complete, format the copy. This can be done using a cut and paste technique, or moved and modified within a computer-aided graphic program. Each design should include the following design considerations:

- short and simple
 - in good taste
 - easy to read
 - represents the event
4. Before continuing, obtain the approval of your instructor. Make an electrostatic copy of the art work.

Make a Thermal Screen Master

1. Place the copied image face up between the screen (film) and the backing sheet.
2. Send the material face-up through a thermal copier (Thermofax machine). For best results, set the copier on the transparency setting or higher. This will transfer your copy on to the screen.
3. Obtain a plastic frame and place double-stick tape along the edges.
4. Keeping the exposed thermal screen stretched, press it down over the double-stick tape on the plastic frame.

Making the Print

1. Place the framed thermal screen over an 8 1/2" x 11" white sheet of paper.
2. Pour a two inch wide puddle of ink along the edge of the screen.
3. With the squeegee held rigidly at a 45 degree angle, pull the ink over the exposed design.
4. Lift the screen up and check the print.
5. When you are satisfied with the quality of the print on your paper, take a stiff piece of cardboard, slide it inside the T-shirt.
6. After you have obtained your teachers approval, pull the T-shirt material tight and place the screen frame and squeegee over the T-shirt.
7. Make a print on the shirt in the same manner as you did on paper.
8. Once finished, Pour excess ink back into the container. Separate the thermal screen from the plastic frame and discard the screen. Finally, wash the squeegee thoroughly and store it in the proper place along with the plastic frame.

Activity Analysis

Directions: Circle the correct answer or fill in the blanks with the best answer.

1. Image carriers are made of which material?
 - A. plastic
 - B. metal
 - C. photographic paper
 - D. rubber composition
 - E. All of the above

2. The printing process in which an image on the outside of a cylinder is transferred to a rubber blanket and then to paper is called _____.

- A. xerography
- B. silk screen printing
- C. offset printing
- D. intaglio printing

3. In screen printing, the screen is made of _____.

- A. silk
- B. metal
- C. polyester (plastics)
- D. may be made from any of the above materials

4. The Thermofax machine uses _____ to etch away the area where the stencil is.

- A. acid
- B. water
- C. light
- D. heat

5. List three examples where silk screen is used as an image carrier.

PROCESSING AND COMMUNICATING
INFORMATION WITH COMPUTERS

PROCESSING AND COMMUNICATING INFORMATION WITH COMPUTERS

Suggested Learning Objectives

Upon completion of the computer technology unit, students will be able to:

- A. Identify the basic elements required to process information including people, hardware, software, and data.
- B. Define and properly use common computer **terminology** like hardware, software, random access memory, read only memory, and microprocessor.
- C. Identify basic **applications** for computer technology including creating graphic illustrations, preparing written documents, making mathematical calculations, and storing large amounts of data.
- D. Describe the basic computer communication **processes** like entering, storing, modeling, scanning, displaying, searching, sending, copying, manipulating, calculating, initializing, and formatting.
- E. Describe the basic human, material, natural, informational, financial, and technological **resources** associated with processing and communicating information with computer technology (e.g., silicon, languages, data).
- F. Describe the social and environmental **impacts** associated with processing and communicating information with computer including operator stress, increased productivity, obsolescence, and energy utilization. SC2
- G. Identify and evaluate **career** opportunities associated with processing and communicating information with computers (e.g., programmer, computer technician, systems analyst) based on their interests, talents, and career expectations.
- H. Identify potential **safety** hazards, establish guidelines for safe behavior, and adhere to common safety practices when around or participating in computer-related activities.
- I. Describe the positive and negative **impacts** of processing and communication information with computer technology (e.g., job displacement, information overloading, improved efficiency). SC2
- J. Identify the major milestones in the **history** and development of computer technology including things like Charles Babbage's Analytical Engine, the ENIAC computer, the development of the integrated circuit and the Crag Super Computer. SS2
- K. Explain how the input, processing, memory and output systems of a computer process and store information.

- L. Identify and properly use common computer input, processing, output, and storage devices. PH6
- M. Use popular computer software and hardware to prepare, edit, and compose a variety of print media including correspondence, charts, graphs, drawings, reports, and newsletters. LA3
- N. Describe how computer technology is used to transmit and receive text and graphic information via telecommunication technologies like electronic mail, facsimile, and on-line databases.
- O. Use popular computer software and hardware to organize numeric data, perform calculations, and make projections.
- P. Distinguish between dedicated and general purpose computers.
- Q. Develop a procedure for solving a simple problem with a computer using pseudo code, flow charts or a high level computer language.
- R. Write, enter, debug, format, and run a computer program that addresses a simple information processing or communication problem.
- S. Select the most appropriate computer software and hardware for a given information processing or communication task.
- T. Assess the advantages and disadvantages of using computer technology to perform a given task. SC2
- U. Practice the procedures used to maintain and protect computer software and hardware.
- V. Integrate the use of computer technology in their academic, avocational, and vocational activities.
- W. Identify and evaluate solutions for solving the ethical problems associated with using computer technology including privacy, copyrights, and dehumanization. SC2

Suggested Learning Activities

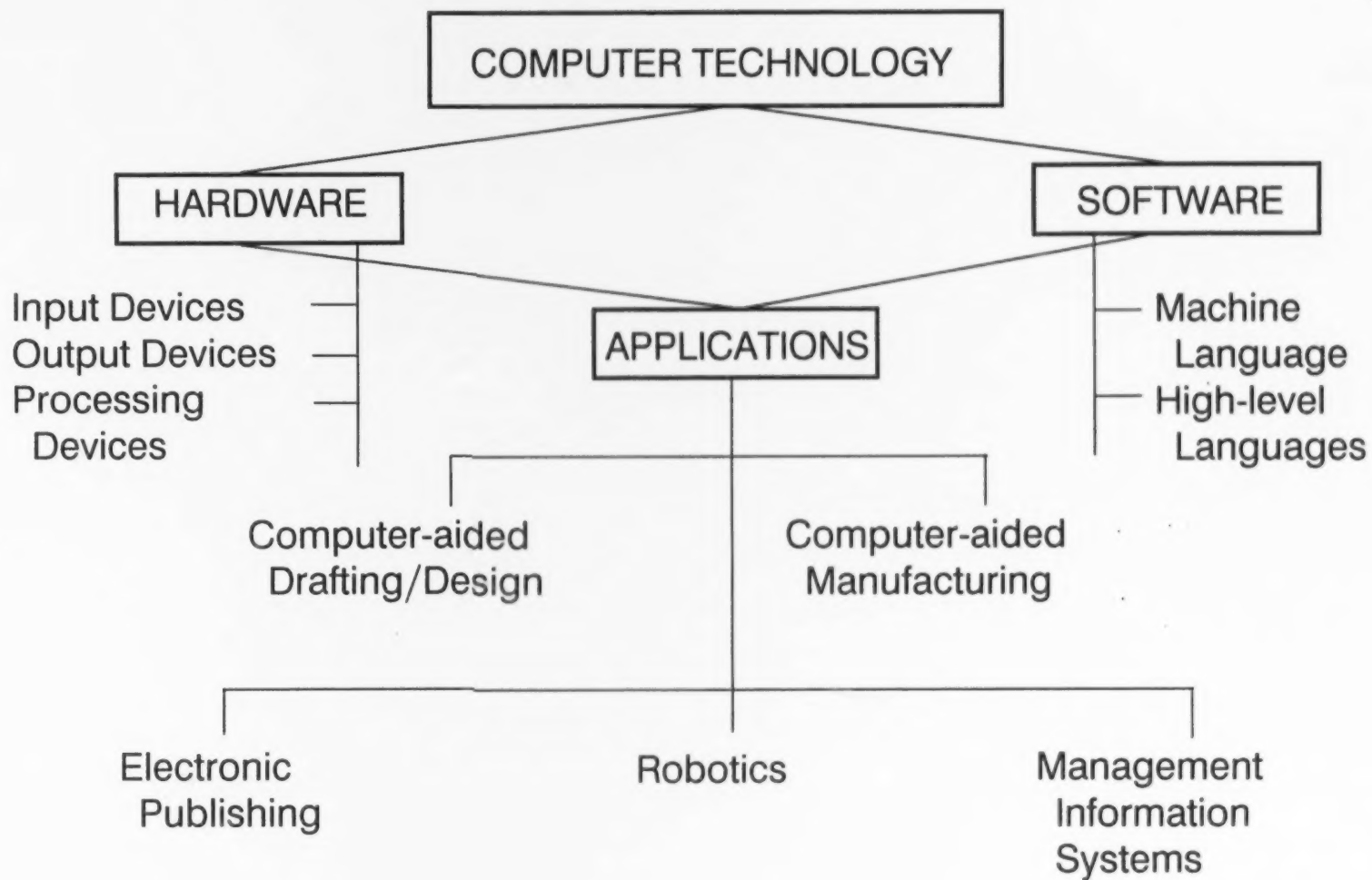
1. Discuss how computer aided instruction is used to help train personnel in business and industry. Use a variety of tutorial programs to introduce students to the world of computing. Include programs that simulate how a computer works and describe how to use a computer. Ask students to identify the advantages and disadvantages of using computers to facilitate instruction.
2. Introduce students to the three basic elements required to process information (e.g., information, hardware, software). Provide students a mathematical problem involving a list of numbers, a sequential series of steps, and a calculator. In groups of three, have students use calculators to process the information and solve the problem. Discuss the basic elements used to process information and how they apply to a variety of

industrial contexts and information technologies. Ask students to identify mistakes that can be made with a calculator or computer. Are there ways to cross-check the mistakes?

3. Discuss how computers are used in industry to solve problems, process information, and create products. Divide the class into two teams and assign the class a problem to solve (e.g., estimate materials for a project, determine total resistance in a complex circuit, develop a poster promoting an event). Have one team address the problem using traditional methods and allow the other team to use a computer and appropriate software. When both teams have finished the assignment, compare the quality of the results and the time required to solve the problem. Discuss how computer technology can help people and organizations be more efficient and competitive in a technological society.
4. Explain how a computer system is a collection of input, processing, and output devices. Using an appropriate software package, have students make posters identifying various parts of a computer system (e.g., RAM, ROM, CPU, monitor, disk drive, keyboard). Create a block diagram illustrating a computer system by displaying and connecting the posters on a bulletin board. Use the block diagram to discuss how a computer system stores and processes information.
5. Discuss how various information processing tasks require special computer peripherals. Demonstrate how to use a variety of input and output devices (e.g., keyboards, joysticks, mouse, printers, plotters, interfaces, modem). During laboratory activities, have students perform information processing and communication tasks that require using a variety of input and output devices. Discuss the information input and output devices used during laboratory activities and how they transfer to a variety of industrial applications (e.g., scanning forms, digitizing drawings, recording image with video cameras, entering data with bar code readers).
6. Explain and demonstrate how to handle and maintain components like computer diskettes, disk drives, printers, printed circuit boards, and keyboards. During laboratory activities, have students follow the procedures used to care for and protect computer software and hardware products. Ask students identify the consequences of mistreating computer technology.
7. Discuss how computer technology is used to control machines and process information. Have students identify applications for dedicated computers (e.g., regulating ignition and fuel systems on automobiles, programming microwave ovens, programming video recorders) and general purpose computers (e.g., accounting, record keeping, word processing, designing). Ask students to describe how computer technology is changing the way we live.
8. Introduce students to the concept of a computer program. Discuss how computer programs are basically lists of instructions that the computer uses to process information. Have students break a simple problem down into a series of simple steps and write a computer program using simple English statements. Possible problems could include things like calculating miles per gallon, displaying a hello logo on the screen, and estimating the price of a house based on cost per square foot. Use the computer programs written in English to write real computer programs. Ask students to explain why people need to be able to describe and develop solutions to problems.

9. Discuss how the logic for a computer program can be described graphically. Explain how to use graphic symbols to develop a flow chart for a simple computer program. During a laboratory activity, have students draw a flow chart for a computer program that displays a question, processes answers, and provides feedback. It should include loops for correct and incorrect responses. Ask students to discuss if the human mind has any capabilities computers do not have. Can a computer detect the ambiguity in the statement, "The skies are not cloudy all day?"
10. Explain how the procedure used to solve a problem must be encoded into a language the computer is programmed to understand. Demonstrate how to enter, list, edit, save, load, and run a new program. Introduce students to a variety of basic computer commands (e.g., Print, For/Next, Goto, If/Then). Have each student write a short computer program that solves a simple problem. The programs should be easy to use, well documented, and formatted for the computer screen.
11. Introduce students to the concept of word processing. Using a simple program, have each student write, edit, and print a simple memo regarding a class or club activity. Include functions like deleting, moving, finding, replacing, and formatting text. Demonstrate how computer software can be used to check things like grammar, spelling, and style. Discuss how word processing technology is changing written communication in the work place.
12. Demonstrate how to use a popular software package to prepare a graphic product. During a laboratory activity, have students write, edit, compose and print a simple graphic product (e.g., poster, newsletters, flyers, labels, brochures). Discuss the positive and negative impacts of electronic typesetting and publishing on the graphic arts industry.
13. Explain and demonstrate how information can be transmitted and received via telecommunication technologies. Using a modem equipped computer, have students access an electronic bulletin board, receive messages from others, and enter new messages. If you do not have a modem, consider using an electronic mail or data base program to have students transmit and receive electronic mail from you, their classmates, and students enrolled in their classes.
14. Discuss how graphic products can be composed in one location and transmitted to another for duplication and dissemination. Consider establishing a communication network between two or more schools. During laboratory activities, have students use a modem equipped computer to exchange newsletters electronically. Discuss how telecommunications technology is changing the graphic arts industry.
15. Assign each student a topic that needs to be researched. Demonstrate how to use a modem-equipped computer to access and use an on-line database. Have students conduct a search, preview bibliographic citations, and extract documents on their topic from the data base. Discuss the positive and negative impacts of having almost instant access to libraries of information.

16. Discuss how computer technology can be used to process data in a variety of industrial contexts (e.g., research and development, production, business). Using an appropriate software package, have students process the numeric information needed to operate a student enterprise or solve a problem (e.g., project a profit margin, determine quality control standards, calculate the efficiency of a device). Ask students to identify the advantages and disadvantages of using computers to perform complex calculations.
17. Discuss the career opportunities in computer technology. Include occupations at the non-skilled, semi-skilled, skilled, technician, and professional levels in the discussion. Using library and guidance resources, have students gather information and present a short written or verbal report about an occupation related to computer technology. Each report should include information about the educational requirements, working conditions, benefits, salary, and advancement potential related to the occupation. Ask students to evaluate the career based on their interests, talents, and career expectations.
18. Discuss the milestones in the history and evolution of computer technology. Assign each student a historical event. Using library resources, have students gather information and develop an abstract describing the people, dates, places, and impacts associated with their assigned event. Encourage students to illustrate their abstracts. Post each abstract on a large timeline. Ask students to describe how given events influenced our culture and subsequent technological developments.



INTRODUCTION TO INFORMATION PROCESSING

Introduction

Solving problems often means you have to process information. The four basic elements needed to process information are data, procedures, computer technology, and people.

For example, estimating how much will it cost to build a house is a problem that requires information processing. A lot of information has to be processed to know the cost of building a house. If information is processed correctly, you will know how much money needs to be borrowed to build the house.

In order to estimate the cost, you will need data. Data is basically the information needed to solve the problem. You need to know what kinds of materials are needed, how much of each material you will need, and how much each type of material will cost.

Next, you will need to know how to process the information. The steps you need to follow to estimate the cost of the house are called procedures. There are two basic types of procedures. The first type, called job instructions, is for people. They tell the builder how to process the information. The second type, called programs, is instructions for computers. Programs are written in a language the computer can read and understand.

Unless you want to figure the cost of the house by hand, you will need some form of computer technology. Computer technology can make information processing faster and easier. Computer technology is involved in something as small as a hand-held calculator or as big as a computer which needs its own room.

Lastly, you need other people to help process the information. A variety of people are involved in estimating the cost of building the house. Someone needs to gather information about how big the house will be and what kinds of materials are needed. Computer programmers have to write the program needed to process the information. People from the lumber yard need to provide the cost of each type of material. You will need a computer operator to enter the data into the computer.

Materials and Supplies

- Calculators for groups of 3 students
- Access to an Apple II series computer

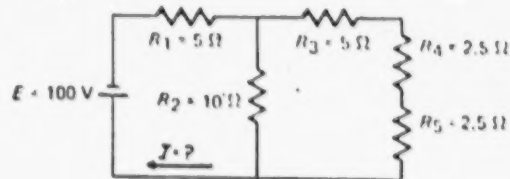
Problem Statement

An electrician is working on a circuit and needs to know the amount of current flowing through the circuit. In this activity, your team will be playing the role of the computer and process the information needed to solve the problem.

Activity Procedures

- Using the data and steps listed below and a calculator, find the value of "I" (the current flowing through the circuit).

$R_1 = 5 \text{ OHMS}$
 $R_2 = 10 \text{ OHMS}$
 $R_3 = 5 \text{ OHMS}$
 $R_4 = 2.5 \text{ OHMS}$
 $R_5 = 2.5 \text{ OHMS}$
 $E = 100 \text{ VOLTS}$
 $I = ? \text{ AMPS}$



Steps:

- Add R_3 , R_4 , and R_5 together and call the answer R_{345} .
- Multiply R_{345} times R_2 and call the answer R_{2345M} .
- Add R_{345} and R_2 together and call the answer R_{2345A} .
- Divide R_{2345M} by R_{2345A} and call the answer R_{2345T} .
- Add R_{2345T} to R_1 and call the answer R_T .
- Divide E by R_T and call the answer I .
- If I is current, how much current is flowing through the circuit?

$I = \underline{\hspace{2cm}} \text{ AMPS}$

- Now, using the program listed on SH #1, process the same information (NOTE: To save time, the program can be entered prior to class.

NOTE: The program was written in Basic for Apple II computers. It must be modified to work on IBM or compatibles.

LIST

```

10  REM  INFORMATION PROCESSING
20  REM  INTRODUCTION PROGRAM
30  HOME
35  REM  ENTERING PROBLEM DATA
40  VTAB 5: HTAB 5
50  PRINT "WHAT IS THE VALUE OF:"
60  VTAB 8: HTAB 8
70  PRINT "R1"
80  VTAB 8: HTAB 12
90  INPUT R1
100 VTAB 10: HTAB 8
110 PRINT "R2"
120 VTAB 10: HTAB 12
130 INPUT R2
140 VTAB 12: HTAB 8
150 PRINT "R3"
160 VTAB 12: HTAB 12
170 INPUT R3
180 VTAB 14: HTAB 8
190 PRINT "R4"
200 VTAB 14: HTAB 12
210 INPUT R4
220 VTAB 16: HTAB 8
230 PRINT "R5"
240 VTAB 16: HTAB 12
250 INPUT R5
260 FOR X = 1 TO 1000: NEXT X
270 HOME
280 VTAB 5: HTAB 5
290 PRINT "WHAT IS THE VALUE OF E?"
295 VTAB 10: HTAB 15
300 INPUT E
305 REM SOLVING THE PROBLEM
310 A = R3 + R4 + R5
320 B = ((A * R2) / (A + R2))
330 C = B + R1
340 I = E / C
345 REM DISPLAYING THE ANSWER
346 REM TO THE PROBLEM
350 HOME
360 VTAB 5: HTAB 5
370 PRINT "THE VALUE OF I IS  AMPS."
380 VTAB 5: HTAB 23
390 PRINT I
400 VTAB 20: HTAB 5
410 PRINT "HOW WAS THAT FOR FAST INFORMATION"
420 PRINT "      PROCESSING"
500 REM RETURN TO INDEX SECTION
510 FOR X = 1 TO 1000: NEXT X
520 VTAB 23: PRINT "PRESS RETURN TO CONTINUE..": INPUT 2$
530 HOME : VTAB 8: PRINT "LOADING THE INDEX"
540 PRINT CHR$(4);"RUN INDEX"

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COMPUTER HARDWARE

Introduction

A computer system is a collection of devices (hardware) and procedures (software) that work together to process information. Hardware is the physical part of the computer system. If you can touch it, it is hardware.

There are three basic types of computer systems. The smallest is called a microcomputer. Microcomputers are often called "home" or "personal" computers and are popular tools in schools and small businesses. They are small enough to fit on a table or desk, but can only have one user at a time, and have a limited amount of power. As computer technology advances, however, microcomputers are becoming more powerful. Many of the microcomputers made today are as powerful as the big computers made about 10 years ago.

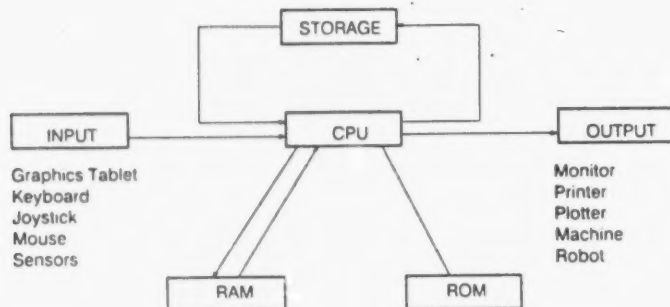
A medium size computer, called a minicomputer, needs its own small room. More than one person can use a minicomputer at the same time. They are more powerful than a microcomputer because they can process more information faster. Minicomputers are often used in medium-sized businesses. For example, a small manufacturing company may keep its inventory, personnel, and sales records in a minicomputer.

Large computer systems, called mainframe computers, often require more than one room for all the hardware, and are very powerful. They can handle more information and process it even faster than a minicomputer. In addition, many people can use the computer at the same time. A mainframe computer can handle the information processing needs of a university, a big hospital, or a large manufacturing company.

No matter how big or small computer systems are, they have the same basic types of hardware. All computers have input devices, processing devices, output devices, and storage devices. A small calculator is a computer. The buttons you push are input devices. The display is an output device. The microprocessor, or chip, inside the calculator is the processing device. Some calculators have a chip inside that can store the information you enter.

Information can be entered into a computer with a variety of devices. Some input devices include the keyboard, a joystick, a mouse, a graphics tablet, and sensors. These devices can be used to enter text (words) or graphics (pictures) into the computer system. When a computer is connected to another system or machine, sensors are used to input information into the computer. Sensors are activated by mechanical movement, electricity, heat, light, or sound.

Once information is entered into the computer, it must have procedures (instructions) to process the data. These procedures are stored in the computer's memory. One type of computer memory is called ROM. ROM stands for "read only memory." Instructions for accepting, managing, and outputting information are stored in ROM. These instructions are put into the computer when it is made so you cannot change them easily.



The second type of memory is called RAM. RAM stands for "random access memory." When information is entered into the computer, it is stored in RAM. Information is actually processed in the "central processing unit" (CPU). In a microcomputer, the CPU is a microprocessor -- a computer chip. Large computers have a CPU which holds many microprocessors. The CPU, ROM, and RAM all work together to process information.

If you turn your computer off, all the information stored in RAM is gone. You need to be able to store programs and information outside of the computer. The first modern computers used mechanically punched cards to store information. Information was stored in the form of holes punched in the cards. When you wanted to enter information, the computer would read the cards. This was a very inefficient way of storing information. Most computers store information magnetically, like music is stored on a cassette tape. Your tape player converts this stored information into music. Computers work basically the same way. Information and programs are stored magnetically on cassette or magnetic tape, or on a floppy or hard disk. You will most likely be working with floppy disks.

After the computer has processed your information, you want to be able to see it. The computer can use a variety of output devices to show the processed information. A monitor, which looks like a television screen, shows the information while you are working on the computer. When you want a typed copy of the information, a printer is used as an output device. If you use the computer to make pictures, a plotter can be the device for drawing the final picture.

Some printers can also be used to print graphics. A computer used to perform a physical task in industry often uses a machine or robot for an output device.

Computer systems come in a variety of sizes and uses a variety of devices to input, process, store, and output information.

How to Care for Your Diskettes:

The programs you write and use are stored on diskettes. If the diskette is damaged, the program will be lost. Here are a few rules to help you take care of your disks.

1. Never place a disk near a magnet.
2. Do not put a disk on top of a monitor, because monitors put out a magnetic field that can erase the disk.
3. Never leave a diskette in direct sunlight.
4. Do not expose a diskette to extreme hot or cold.
5. Always put a disk back into its paper envelope when it is not in the disk drive.
6. Do not store disks inside books or stack books on top of a diskette.
7. Do not let disks get dusty, dirty or wet
8. Never touch the exposed Mylar part of the diskette.
9. Do not write on a disk label with pen or pencil. Use a felt tip pen or fill out the label before you put it on the disk.

Operation Commands for Apple II, II+, OR IIe (Registered Trademark)

In order to enter your first program, you need to learn a few of the commands used to operate the computer. Here is a list of basic operating commands and what they do.

prompt character - means your computer is ready for you to input information or commands

RETURN	used to issue a command to the computer - it is also used to end a statement line and begin a new one
LIST	will display on the monitor screen a list of the programs currently in the memory
RUN	run the program currently in the memory
NEW	clears the memory so a new program can be entered
LOAD	loads (moves) a program into the memory from the disk
SAVE	saves (stores) the program currently in memory on to a disk

CATALOG shows you a list of the programs stored on the disk (table of contents for the disk)

moves the input cursor (the winking checkered box) to the right

moves the input cursor to the left

Materials and Supplies

- Apple II series computer
- Software (DOS 3.3. system master disk)

NOTE: Even though this activity is written for an Apple II series computer, with a few modifications, other systems like IBM, IBM compatibles, and Commodore can be used to complete this activity.

Activity Procedures

Disks are made to be used in any computer system. Each disk in a new box is blank. Before you can use your new disk in the computer, you must install a program called the "disk operating system" (DOS). DOS tells the computer how to use the disk. Installing DOS onto a new blank disk is called "initializing" the disk.

In addition to initializing, you need to create storage places on the disk. These storage places are like houses on a block. Each house has a yard and an address. The information you will want to store on the disk needs an address and a storage place. Initializing a disk also creates addresses and storage places.

How to Initialize a Diskette

Listed below are the steps required to initialize a diskette. Read them carefully and follow them one by one.

1. Get an operating systems master disk (e.g., DOS 3.3 ProDos) and a blank disk from your teacher.
2. With the computer off, open the door on the disk drive and put in the Systems Master with the label facing up. Close the disk drive door.
3. Turn the computer on. The disk light should come on.
4. When the disk light goes off, you should see information on the screen. You need to enter what is called a "Hello" program. This program will display basic information about the disk when it is used in the future. Type the program below exactly as you see it.

Where specific information is requested in small letters, type what applies to you.

Push the RETURN key after every line.

```
10 REM HELLO PROGRAM
20 HOME
30 PRINT "type in your name"
40 PRINT "INDUSTRIAL TECHNOLOGY CLASS"
50 PRINT "type in your class period"
60 PRINT "type in the data"
```

5. When you are sure everything is typed correctly, open disk drive door and remove the Systems Master disk. Put the Systems Master disk back into its paper envelope. Put your blank disk in the disk drive and close the door.
6. Type in INIT on the screen and press the return key. The disk drive light should come on and the disk drive will make a whirring sound.
7. When the disk drive stops and the light goes off, your hello message should be displayed in the upper left part of the screen. See the example list below.

```
JOHN SMITH
INDUSTRIAL ARTS CLASS
5TH HOUR
NOV. 10, 1990
```

8. If there is something wrong with your hello message, type the word LIST and press the return key. This command will display your hello program. Check the program for mistakes. If you find the problem, retype the whole line. Your computer is very dumb, so if you do not tell it exactly what to do, it will not work. If you cannot find the problem, ask your teacher for help.
9. Once you make corrections, type the word RUN and press the return key. Your hello program should be displayed in the upper left part of the screen. If there is still something wrong with the hello program, go back to step number 8 and try again.
10. When your hello program works, type SAVE HELLO and press the return key. This will save your hello program in the first storage space on your diskette.
11. To make sure you save your program, type CATALOG and press the return key. This command will display the catalog which contains your hello program. As you write more programs, the list of programs in the catalog will grow longer.

Activity Analysis

1. List and describe three basic types of computer systems.

A. _____

B. _____

C. _____

2. Discuss the role and relationship of RAM, ROM and CPU in a basic computer system.

COMPUTER LANGUAGES AND SOFTWARE

Introduction

You have learned that a computer system is a collection of devices (hardware) and procedures (software) that work together to process information. You have learned that hardware is the physical part of the computer system. Computers are very stupid; they cannot think. In order to perform a task, they must be told every step. A series of step by step instructions that tell the computer hardware what to do is called computer "software" or a "program." The instructions given to the computer must be complete, in order, and logical. Without software, a computer is useless. A computer system is only as good as its software or programming.

How do you tell a computer what to do? You have to talk to it in its own language. There are two basic kinds of computer languages. The first one is called machine language. Machine language is the only language the computer really understands. Machine language is basically a series of 1s and 0s called binary numbers. The binary "1" and "0" turn electronic switches on (1) and off (0). The computer processes information by connecting a series of these electronic switches in patterns. One binary digit is called a "bit." A group of 8 binary digits (bits) is called a byte. A school computer can often store 64k, or 64,000 bytes in its memory.

Few people really know machine language well enough to program a computer. Most people program computers with a "high-level" computer language. High-level computer languages are more like English than machine language is. However, the computer must convert the high-level language into machine language before it can perform the desired task. A program written in even a high-level language still looks like a foreign language to most people. Look at the example below.

```
430 PRINT "4. A.";
435 DIM R$(10)
440 INPUT R$
445 IF R$(1,1) = "F" THEN 495
450 GOSUB 1180
455 GOTO 465
```

There are four basic types of high-level languages. The example in the preceding page is written in BASIC. BASIC is an acronym for Beginner's All-purpose Symbolic Instruction Code. This is the most commonly used high-level language for microcomputers.

Another common high-level computer language is called COBOL. COBOL is an acronym for Common Business Oriented Language. This high-level language was developed for business applications.

FORTRAN is a language designed primarily for scientific and engineering applications. It is an acronym for FORmula TRANslator.

LOGO is the only computer language developed specifically for children and education. It is a very easy to learn and use high-level language. Students often write programs in LOGO to draw designs and pictures on the screen.

Exploring Basic

By learning a few commands in the BASIC you can become a computer programmer. You will be able to program a computer to solve industrial problems. The best way to learn commands is to use them on the computer. Before you start programming, you may want to review your operating commands. Listed below are the basic operating commands and what they do.

]	prompt character - means your computer is ready for you to input information or commands
RETURN	used to issue a command to the computer - it is also used to end a statement line and begin a new one
LIST	will display a list of the programs currently in the memory on the monitor screen
RUN	will execute (run) the program currently in the memory
NEW	clear the memory so a new program can be entered
LOAD	loads (or moves) a program into the memory from the diskette
SAVE	saves (or stores) the program currently in memory on to a diskette
CATALOG	shows you a list of the programs stored on the diskette (a table of contents for the disk)
--->	moves the input cursor (the winking checkered box) to the right
<---	moves the input cursor (the winking checkered box) to the left

Materials and Supplies

- Access to an Apple II series computer

NOTE: This activity can be modified to work with other computer systems like IBM and compatibles.

Activity Procedures

REM and PRINT

The first commands you will explore are REM and PRINT. The REM command allows you to put remarks or notes in your program. The computer will not try to read the information you put after a REM command. If you wanted to put your name in a program, you would need

to type a line number, REM, and your name (10 REM JOHN SMITH). Your name would not appear on the screen when you run the program.

The PRINT command will display text on the screen. If you wanted a message to appear on the screen, you would need to type a line number, PRINT, and your message in quotes (10 PRINT "ACME JR. HIGH RULES"). If you do not want to type PRINT every time you want text to appear on the screen, use a question mark (?) instead of PRINT. When you LIST your program, the computer will type command PRINT where it finds your question marks.

Let's get started. Boot your diskette by putting it in the disk drive and turning on the computer. When the disk drive stops, you should see your hello message on the screen. Type the word NEW and press return. Enter and run the introduction program listed below. Remember, your computer is stupid. You have to tell it everything. Type the program exactly as it is listed below.

```
10 REM *****
20 REM INTRODUCTION PROGRAM
30 REM BY _____
40 REM *****
50 HOME
60 PRINT "WHAT IS YOUR NAME?"
70 INPUT N$
80 VTAB 10: HTAB 10
90 PRINT "HELLO, ";N$
100 END
```

Using PRINT and MATH Statement

The introduction program is still on the screen. Before we can explore a new command, you will need to clear the screen. Type the word HOME and press the return key. The command HOME clears the screen. However, your first program is still in the computer's memory. Type the word RUN. See what I mean? Clear the screen by typing HOME, press return, type the word NEW, and press return. Now the screen and the memory are both empty. Type the program listed below exactly as it is listed.

```
10 REM *****
20 REM USING PRINT AND
30 REM MATH STATEMENTS
40 REM *****
50 HOME
60 PRINT "ADDITION PROBLEM: 28 + 49"
70 PRINT "THE ANSWER IS ";28 + 49
80 PRINT
90 PRINT "SUBTRACTION PROBLEM: 83-47"
100 PRINT "THE ANSWER IS ";83-47
110 PRINT
120 PRINT "MULTIPLICATION PROBLEM: 19*51"
130 PRINT "THE ANSWER IS ";19*51
140 PRINT
150 PRINT "DIVISION PROBLEM: 73/14"
```



```
160 PRINT "THE ANSWER IS ";73/14
170 END
```

When you are done entering the program, type RUN and press the return key. You should notice several things. Your REM statements did not appear on the screen. Secondly, when you typed the math problems inside the quotes they were printed on the screen. When you typed the math problems outside the quotes, the computer printed the answer. Thirdly, when you typed the command PRINT by itself, it left a handy space on the screen. Lastly, you can add with a + sign, subtract with a - sign, multiply with an *, and divide with a / mark.

Using Numeric Variables

Numeric variables allow you to store a number in a storage space. You can give the storage space a one or two letter name (for example A). If you wanted to store the number 5 in storage space A, you would type A=5 after a line number. Every time you use the name (A), the computer goes to the storage space and gets the number you stored in it (5). Try using numeric variables by entering and running the following program. You may want to try putting different numbers in the storage places B and C. Try calling the storage places X and Y if you want.

```
10 REM *****
20 REM USING NUMERIC VARIABLES
30 REM *****
40 HOME
50 B=25
60 C=41
70 PRINT B+C
80 END
```

Using String Variable and Input Statements

String variables work a lot like numeric variables. The difference is that you use string variables to put words instead of number in a storage place. To make sure the computer knows you are storing words, you use a letter followed by a dollar sign (\$) when naming the storage place. String variables are often used to provide a storage space for an answer to a question. When a program asks the computer user a question, the computer has to have a storage space for the answer that is typed in. The command that allows the user to type something is called INPUT. Try using a string variable and an input statement by entering and running the program listed below.

```
10 REM *****
20 REM USING STRING VARIABLES
30 REM *****
40 HOME
50 PRINT "WHAT IS THE NAME OF YOUR SCHOOL TEAM?"
60 INPUT N$
70 PRINT "THE ";N$;" ARE NUMBER ONE"
80 END
```

Using A FOR/NEXT Loop

Sometime when you are writing a program, you want the computer to count from one number to another. Type and run the program listed below.

```
10 REM *****
20 REM USING A FOR/NEXT LOOP
30 REM *****
40 HOME
50 PRINT "LOOK MOM, I GOT STRAIGHT A'S"
60 FOR X = 1 TO 1000
70 NEXT X
80 FOR X = 1 TO 20
90 HTAB 26
100 PRINT "A"
110 NEXT X
120 END
```

How many "A's" did you get? How did the computer know to give you 20 A's? I bet you are glad you do not have 20 classes. You used a FOR/NEXT loop for two applications in this program. In line 60 you told the computer that the numeric variable "X" was first equal to "1" (FOR X = 1 to 1000). In line 70, you told the computer to go to the "NEXT X." The computer went back to line 60 and made "X" equal to 2 and then it went back to line 70. Line 70 told the computer to go to the NEXT X. This made X equal to 3 in line 60. This process continued until the computer reached 1000 (FOR X = 1 TO 1000). After the computer counted to 1000, it progressed to line 80. On the screen lines 60 and 70 looked like a pause. Creating a pause on the screen is one of the applications for a FOR/NEXT loop.

In lines 80, 90, 100, and 110, you told the computer to print an "A" on the screen 20 times. Line 80 told the computer X was equal to 1. Then the computer went to line 90 and 100 where it was told to print an "A" in a given location on the screen. In line 110, you told the computer to go to the next value of X (2). The computer continued this process until it counted to 20 and printed 20 "A's" on the screen. The second application for FOR/NEXT loops is to tell the computer to repeat a task (like printing "A's") a given number of times.

Using a GOTO Loop

Another way to tell a computer to repeat something over and over again is to use a GOTO command. Let's say the computer has read line 10 to 50 and you want it to do it over again. In line 60, you would tell the computer to GOTO 10. When the computer reads line 60 it will go to line 10 and start over again. Unfortunately, your computer is stupid: it will keep going back to line 10 until you tell it to stop. If you want a computer to stop in the middle of a program, you have to push the control key and the letter C at the same time. Enter and run the program listed below. You will need to hold the control and press the letter C to stop the program.

```
10 REM *****
20 REM PUTTING IT ALL TOGETHER
30 REM *****
40 HOME
```

20-C

```

50 PRINT "WHAT IS YOUR NAME?"
60 INPUT N$
70 HOME
80 PRINT "**** ";N$;" IS A PROGRAMMER ****"
90 PRINT
100 FOR X = 1 TO 1000
110 NEXT X
120 GOTO 80
130 REM YOU WILL NEED TO
140 REM PRESS THE CONTROL
150 REM KEY AND THE LETTER
160 REM C TO STOP THE
170 REM PROGRAM.

```

Using VTAB and HTAB

When writing a program, you often want to arrange the information on the screen so it looks good. This is called formatting. The basic commands used to format (arrange information on the screen) are VTAB and HTAB. You have entered several programs using these two commands. The "V" in VTAB stands for vertical (up and down). Your computer has 24 lines on the screen. The computer automatically starts displaying information on the top line and works its way down the screen. However, if you want to print a message halfway down the screen, you would type a line number followed by VTAB 12. The next line in the program would include the print command and the message in quotes. When the computer reads the program it would be told to go halfway down the screen. Then it would be told to print the message.

The "H" in HTAB stands for, you guessed it, horizontal. Your screen has 40 columns (spaces) for 40 characters (letters) per line across the screen. If you wanted to print your name in the middle of the screen, you would type a line number followed by VTAB 12, a colon (:), and HTAB 12. The next line number would be followed by the PRINT command and your name in quotes. When the computer reads the program, VTAB 12 would tell the computer to move halfway down the screen and HTAB 12 would tell the computer to move over 12 spaces from the left side of the screen. The PRINT command in the next line would put your name on the screen. To keep the VTAB and HTAB commands separate, you need to type a colon (:) between them (VTAB 12:HTAB 12). Enter and run the program listed below.

```

10 REM *****
20 REM USING VTAB & HTAB STATEMENT
30 REM *****
40 HOME
50 VTAB 5: HTAB 5
60 PRINT "INDUSTRIAL"
70 VTAB 10: HTAB 15
80 PRINT "ARTS"
90 VTAB 15: HTAB 20
100 PRINT "IS GREAT!!!"
110 END

```

Using IF/THEN Statements

Sometimes information processing requires a decision to be made in the program. The command used for making decisions is called an IF/THEN statement. The IF/THEN statement tells the computer to do one thing under one condition and something else under a different condition. IF your homework is done, THEN go outside. IF your homework is not done, THEN go do it. To make a decision in the program, IF/THEN statements are often included in a string variable and a GOTO statement. Enter and run the program listed below. Notice how the program will jump to given lines depending on the input.

```
10 REM *****
20 REM USING IF/THEN STATEMENTS
30 REM *****
40 HOME
50 PRINT "OTHER THAN LUNCH, INDUSTRIAL ARTS IS"
60 PRINT "THE BEST CLASS OF THE DAY (T OR F)"
70 INPUT A$
80 IF A$ = "T" THEN GOTO 100
90 IF A$ = "F" THEN GOTO 120
100 PRINT "YOU KNOW WHERE THE ACTION IS"
110 END
120 PRINT "THERE IS NO ACCOUNTING FOR TASTE"
130 END
```

Activity Analysis

1. Explain the difference between machine language and high-level computer language.

2. List and define four types of high-level languages.

3. Identify a situation where computer programs can be used to process information quicker, easier and more efficiently than by hand.

WRITING A PROGRAM IN BASIC

Introduction

Now that you have planned your program, you need to ask yourself this question; How do I tell the computer what I want it to do? Remember, you have to talk to the computer in a language it can understand. The computer can not understand English. Therefore, programs written in English need to be converted to programs written in a computer language.

There are three basic considerations for writing a program. The first consideration is called documentation. Documentation provides information about the program like what does it do and who wrote it. In addition, documentation is used to label parts of the program and describe how they work. Computer programs can be hundreds and even thousands of pages long. When trouble-shooting a long program, it is important to be able to locate the trouble spot and make corrections. In Basic, REM statements are used to document a program.

It is not enough that the program works, it has to look good. The process of making a program's output look good on the screen is called formatting. Formatting is our second basic consideration when writing a program. Commands like VTAB, HTAB, and PRINT can be used to arrange information on the screen so it is easy to read and looks good.

Lastly, the program needs to be easy to use. Programs that are easy to use are called "user friendly." When a program is user friendly, the user does not have to guess how to use it. The program introduces itself, it is easy to read, and easy to follow. A good way to make sure your program is user friendly is to have several friends try it. Watch what they do. Do not provide any help. If they can use the program without any problems, it is probably user friendly enough for this project.

Examine the example problem and program on the following page. Notice how the documentation and formatting were included in the program.

Example Problem

Write a computer program that estimates the cost of a project based on the number of linear feet entered and the entered cost of material per linear foot.

Question 1: What do I want the computer to do?

- A. clear the screen
- B. tell the user the purpose of the program
- C. leave a space
- D. ask the user how many feet of material will the project require
- E. allow the user to enter the number of feet
- F. leave a space
- G. ask the user how much the material costs per foot
- H. allow the user to enter the cost
- I. multiply the amount of material needed by the cost of the material
- J. leave a space
- K. tell the user how much the project will cost
- L. end the program

Example Program

```
10 REM *****
20 REM EXAMPLE PROGRAM FOR THE
30 REM COMPUTER PROGRAMMING PROJECT
40 REM *****
43 REM
44 REM *****
45 REM BY JOHN SMITH
46 REM ACME JR. HIGH
47 REM *****
50 HOME
60 PRINT "THIS PROGRAM WILL ESTIMATE THE"
70 PRINT "COST OF A PROJECT BASED ON THE"
80 PRINT "LINEAR FEET OF MATERIAL NEEDED"
90 PRINT "AND THE COST OF THE MATERIAL"
100 PRINT "PER LINEAR FOOT."
110 PRINT : PRINT
120 PRINT "HOW MANY LINEAR FEET OF MATERIAL"
130 PRINT "WILL THE PROJECT REQUIRE?"
140 INPUT LF
145 REM LF = LINEAR FEET
150 PRINT : PRINT
160 PRINT "WHAT IS THE COST OF THE MATERIAL"
170 PRINT "PER LINEAR FOOT?"
180 INPUT C
185 REM C = COST PER FOOT
190 PRINT : PRINT
195 REM FIGURING COSTS
200 PC = LF * C
205 REM PC = PROJECT COST
210 PRINT "YOUR PROJECT WILL COST ABOUT $";PC
220 END
```


How the Program Works

Lines 10 through 47 provide documentation regarding the purpose of the program and the author. In line 50, the command HOME tells the computer to clear the screen.

Using PRINT statements, lines 60 through 100 introduce the user to the program. The introduction tells the user what the program can do. Line 110 uses two PRINT commands to leave a space on the screen (formatting).

Lines 120 and 130 ask the user to enter the amount of materials needed for a project. The INPUT statement in line 140 allows the user to enter the number of linear feet. Notice, the meaning of LF is explained with a REM statement in line 145. Line 150 formats the screen with two more spaces. The user is asked the cost of the material per foot in lines 160 and 170. A REM statement tells you what "C" stands for (cost) in line 185. Once again, two PRINT statements are used to format the screen.

Line 195 labels the section of the program that figures the cost of the project. Line 200 tells the computer that the cost of the project equals the number of linear feet multiplied by the cost of the materials per foot. Line 205 explains the meaning of "PC." The PRINT statement in line 210 tells the user the cost of the project. Line 220 ends the program.

Materials and Supplies

- Pencil
- Eraser
- Access to Apple II computer
- Students' data disk

Writing a Program in BASIC Directions

Using your program planning activity as a guide, write a program using the Basic computer language. Follow the steps listed below when writing your program.

1. Convert each statement written in English to commands in the Basic computer language.
2. Document your program using REM statements. Include a title for the program and the name(s) of the author(s). You may want to label special sections of the program.
3. Have your teacher approve your program.
4. Enter your program in the computer and save it on a diskette.
5. Run the program. Identify trouble spots and make corrections. After the corrections have been made, save the program again using the same file name.
6. Now that the program works, it is time to make it look good. Add VTAB, HTAB and/or PRINT statements to make your program's output look nice.

7. When you are sure your program is done, save it one last time. Turn your diskette into your teacher for evaluation.

Activity Analysis

1. What are three basic considerations when writing a computer program?

Teacher Supplement

The following pages contain sample program solutions to the problem identified in the previous activity. As a teacher, you may want to refer to these sheets when helping students troubleshoot their programs.

```
10 REM *****
20 REM EXAMPLE PROGRAM #5 FOR THE
30 REM COMPUTER PROGRAMMING PROJECT
40 REM *****
50 HOME
60 PRINT "THIS PROGRAM WILL FIGURE"
70 PRINT "YOUR GAS MILEAGE."
80 PRINT : PRINT
90 PRINT "HOW MANY MILES DID YOU DRIVE?"
100 INPUT M
110 PRINT : PRINT : PRINT
120 PRINT "HOW MANY GALLONS OF GAS"
125 PRINT "DID YOU USE?"
130 INPUT G
140 PRINT : PRINT : PRINT
150 GM = M / G
160 PRINT "YOU GOT ";GM;" MILES PER GALLON."
170 END
```

```
10 REM *****
20 REM EXAMPLE PROGRAM #6 FOR THE
30 REM COMPUTER PROGRAMMING PROJECT
40 REM *****
50 HOME
55 REM DRAW A BOX ON THE SCREEN
60 VTAB 2
70 PRINT "*****"
80 FOR X = 1 TO 18
90 PRINT "**                **"
100 NEXT X
110 VTAB 20
120 PRINT "*****"
125 REM PUT INFORMATION IN THE BOX
130 VTAB 5: HTAB 8
140 PRINT "ACME JUNIOR HIGH SCHOOL"
150 VTAB 6: HTAB 12
160 PRINT "INDUSTRIAL TECHNOLOGY"
170 VTAB 12: HTAB 9
180 PRINT "JOHN SMITH'S PROGRAMS"
190 VTAB 17: HTAB 6
200 PRINT "TYPE CATALOG AND PUSH RETURN"
210 END
```

```

10 REM *****
20 REM EXAMPLE PROGRAM #1 FOR THE
30 REM COMPUTER PROGRAMMING PROJECT
40 REM *****
50 HOME
60 PRINT "THIS PROGRAM WILL ESTIMATE THE"
70 PRINT "COST OF BUILDING A HOUSE BASED"
80 PRINT "ON THE NUMBER OF SQUARE FEET."
90 PRINT : PRINT : PRINT
100 PRINT "HOW MANY SQUARE FEET WILL THE"
105 PRINT "HOUSE BE?"
110 INPUT SF
120 PRINT : PRINT : PRINT
130 PRINT "WHAT IS THE COST OF CONSTRUCTION"
140 PRINT "PER SQUARE FOOT?"
150 INPUT C
160 TC = SF * C
170 PRINT : PRINT : PRINT
180 PRINT "THE HOUSE WILL COST ABOUT $";TC
190 PRINT "TO BUILD."
200 END

```

```

5 HOME
10 REM *****
20 REM EXAMPLE PROGRAM #2 FOR THE
30 REM COMPUTER PROGRAMMING PROJECT
40 REM *****
50 PRINT : PRINT : PRINT
55 HTAB 8
60 PRINT "*****"
65 HTAB 8
70 PRINT "THINK TECHNOLOGY EDUCATION"
75 HTAB 8
80 PRINT "*****"
90 FOR X = 1 TO 1000
100 NEXT X
110 GOTO 50
120 REM YOU WILL NEED TO PUSH
130 REM THE CONTROL AND THE
140 REM C KEY TO STOP THE
150 REM PROGRAM

```

```

10 REM *****
20 REM EXAMPLE PROGRAM #3 FOR THE
30 REM COMPUTER PROGRAMMING PROJECT
40 REM *****
50 HOME
60 PRINT "THE COMMAND USED TO PUT NOTES"
70 PRINT "IN A PROGRAM IS CALLED A
80 PRINT "_____ STATEMENT."
90 PRINT : PRINT
100 PRINT "A. PRINT"
110 PRINT "B. REM"
120 PRINT "C. HOME"
130 PRINT "D. NOTE"
140 PRINT : PRINT
150 PRINT "TYPE A, B, C, OR D"
160 INPUT A$
170 PRINT
180 IF A$ = "A" THEN 230
190 IF A$ = "B" THEN 250
200 IF A$ = "C" THEN 230
210 IF A$ = "D" THEN 230
230 PRINT "INCORRECT, PLEASE TRY AGAIN"
240 GOTO 160
250 PRINT "GOOD JOB!!!"
260 END

```

```

10 REM *****
20 REM EXAMPLE PROGRAM #4 FOR THE
30 REM COMPUTER PROGRAMMING PROJECT
40 REM *****
50 HOME
60 PRINT "THIS PROGRAM WILL FIGURE GROSS"
70 PRINT "PROFIT BASED ON THE NUMBER OF"
80 PRINT "PRODUCT SOLD, THE COST TO MAKE"
90 PRINT "EACH PRODUCT, AND THE PRICE OF"
100 PRINT "EACH PRODUCT."
110 PRINT : PRINT
120 PRINT "HOW MANY PRODUCTS WERE SOLD?"
130 INPUT S
140 PRINT : PRINT
150 PRINT "HOW MUCH DID IT COST TO MAKE"
160 PRINT "EACH PRODUCT?"
170 INPUT C
180 PRINT : PRINT
190 PRINT "WHAT WAS THE PRODUCT'S SELLING"
200 PRINT "PRICE?"
210 INPUT P
220 PRINT : PRINT
230 GP = (P - C) * S
240 PRINT "YOUR GROSS PROFIT IS: $";GP
250 END

```

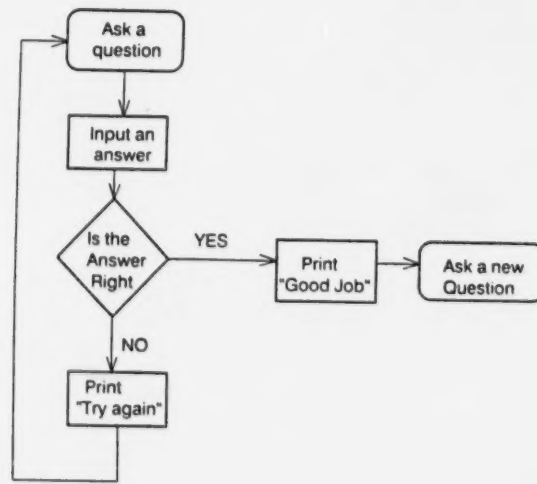
PROGRAM PLANNING

Introduction

You have learned that a computer is really a very stupid machine. It cannot think; you have to do all the thinking for it. You must tell it exactly how to process information. If you make one little mistake in telling it what to do, it will not process the information correctly. A computer system is only as good as the instructions (programming) given to it. If you tell it what to do, it can handle more information and process it faster than you can.

Like any other project, programming requires good planning. Proper prior planning prevents poor performance. In industry, poor planning wastes time, money, human resources and computer resources. Computer time is too important and expensive for it to be wasted. Computer programmers spend more time planning their programs on paper than they do entering them on the computer. If a program is planned properly, the program will not need trouble shooting and refining.

There are two basic ways of planning a computer program. The first one is called flowcharting. Flowcharting is basically drawing a picture or chart of how the program will work. Symbols are used to represent commands. The following flowchart example illustrates a computer program.



Another common method used to plan a computer program is called "pseudo (pretend) code." Basically, pseudo code is a computer program written in English statements. After the computer program has been planned, the English statements can be converted into a computer language. This is a very efficient means of designing a computer program. Most of the people who use computers do not program them. However, everyone who uses a computer should be able to tell a computer programmer what they need a computer to do.

For most people, being able to design a program using English statements is more important than being able to write the program in a computer language.

The first step in planning a computer program is to analyze the problem that needs to be solved. When planning a program, there are three basic questions to be asked: What are the steps required to solve the problem? What order do the steps need to be in? What do I want the computer to do? Look at the example provided. Notice how the questions were answered and how the program evolved.

Example Problem

Write a computer program that estimates the cost of a project based on the number of linear feet entered and the entered cost of material per linear foot.

Question 1: What are the steps required to solve the problem?

- * Multiply the amount of material needed by the cost of the material
- * Ask how many feet of material is needed for the project
- * Ask how much the material will cost per foot
- * Tell the user the cost of the project

Question 2: What order do the steps need to be in?

1. Ask how many feet of material is needed for the project.
2. Ask how much the material will cost per foot.
3. Multiply the amount of material needed by the cost of the material.
4. Tell the user the cost of the project.

Question 3: What do I want the computer to do?

- 10 clear the screen
- 20 tell the user the purpose of the program
- 30 leave a space
- 40 ask the user how many feet of material will the project require
- 50 allow the user to enter the number of feet
- 60 leave a space
- 70 ask the user how much the material costs per foot
- 80 allow the user to enter the cost
- 90 multiply the amount of material needed by the cost of the material
- 100 leave a space
- 110 tell the user how much the project will cost
- 120 end the program

Materials and Supplies

- Pencil
- Eraser

Activity Procedures

Circle your choice of one of the programming problems listed below for your computer programming project. Write the answer to the program planning questions in the spaces provided. Use the example provided as a guide while planning your program.

1. Write a computer program that estimates the cost of a house based on the entered cost per square foot and the entered number of square feet.
2. Write a computer program that illustrates a graphic and/or written message on the screen like an electric sign.
3. Write a computer program that provides the user with a multiple choice question, allows the user to make a choice, and provides the user with appropriate feedback depending on their choice.
4. Write a computer program that determines net profit based on entered costs, the number of products sold, and the price of each product.
5. Write a computer program that calculates the number of miles per gallon that a car gets based on the entered number of miles driven and the number of gallons of gas used.
6. Write a computer program that draws a logo on the screen and can be used for a hello program on a diskette.

Question 1: What are the steps required to solve the problem?

* _____
* _____
* _____
* _____
* _____
* _____

Question 2: What order do the steps need to be in?

1. _____
2. _____
3. _____
4. _____
5. _____

Question 3: What do I want the computer to do?

10 _____
20 _____
30 _____
40 _____
50 _____
60 _____
70 _____
80 _____
90 _____
100 _____
110 _____
120 _____
130 _____
140 _____
150 _____

Activity Analysis

1. Explain why programs need to be planned before they can be written.

2. List the basic questions that need to be answered to plan a program.

3. What are the implications of poorly written programs?

MANAGEMENT INFORMATION SYSTEMS

Running a business requires a lot of information processing. Personnel, inventory, purchasing, billing, and tax records have to be kept, expenses, incomes, and profits have to be figured. Information regarding personnel, production activities and company policy have to be communicated to managers and employees. Before computers, businesses needed rooms of typewriters, adding machines, and filing cabinets to process and store their information. Computers can now do the job of all these tools. Computers make processing information easier and faster.

Processing, storing, and distributing the information needed to manage an enterprise with the help of computer technology is called "Management Information Systems" or MIS. Management information systems are used to perform three major management tasks. The first one is communication. Managers have to be able to accurately communicate with their employees and fellow managers. This often means putting information in writing. Computers are powerful communication tools.

The second major managerial task is record keeping. A business has to keep a lot of records. Many of the records are required by law. Records need to occupy as little space as possible and managers need to have easy access to them. A computer can also be a powerful record keeping tool.

The third area is managing the financial affairs of the company. Managers have to know how much money is coming into the company, how much money the company is spending, and if the company is making a profit. Financial information needs to be as up-to-date as possible. Computers can help managers monitor the financial status of their company.

In order to help manage these areas, four types of software are commonly used. The first one is word processing programs. Word processing programs help management staff prepare written documents with a computer. These documents include things like letters, memos, manuals, and reports. Often these documents need to be written, edited, rewritten, and at a later date, revised. Word processing makes preparing documents faster and easier. Changes can be made in a document without retyping it. Word processing enables the writer to add information, delete information, make corrections, move sentences, move paragraphs, or print the final draft with a few key strokes.

The second type of application software is called data base programs. A data base program reduces the need for filing cabinets. This program enables managers to organize and store information. After the information is stored, it can be rearranged or pulled out to meet the needs of management. For example, data bases are often used to keep personnel records. Through a data base you could easily determine all the employees celebrating a birthday during any given month. Information can be stored, accessed and updated faster and easier in an electronic form than it can be on paper. In addition, since the information is stored electronically, it requires less space.

The third type of application software is called spread sheet programs. Spread sheet programs help managers handle financial information. They make the computer a powerful accounting tool. A spread sheet program helps managers organize information, process data, and forecast the future. Through a spread sheet program, managers can determine the financial status of their company easier and faster than the traditional methods.

The last type of software used to help managers process information is called business graphics programs. Business graphics programs are often a part of spread sheets and data base programs. Through a business graphics program, information can be converted into charts or graphs. In a pictorial form, information becomes more interesting and easier to understand. For managers, business graphics is a very valuable communication tool.

In addition to applications software, MIS often takes advantage of other forms of computer technology. One example is called electronic mail. With electronic mail, documents can be sent to a given destination electronically. This is often cheaper, easier, and faster than sending messages on paper through the post office. The electronic mail can be sent to someone within the company or to another company.

Telecommunications technology enables managers to use their computer to communicate with other computers using the telephone. A device called a modem is used to link the computer to the telephone line. Through this link, information can be sent from one computer to another.

The last MIS support technology is called electronic funds transfer (EFT). This allows managers to move money electronically. Using traditional methods of moving money, it can take days to complete a transaction. With EFT, transactions can be made in seconds.

Management information systems help companies save time, minimize waste, be more productive, and make a profit with the aid of computer technology. A profitable company is a healthy company. Choose a healthy company when you select a job.

The following set of Technology Education Activities will expose students to the use of computers in the management of information.

Materials and Supplies

- Software: word processing (e.g., Apple Writer, Bank Street Writer, Microsoft Word, WordStar), spread sheets (e.g., Apple Works, Multiplan, Visicalc, Wings, Lotus, Quattro) data base (e.g., Bank Street Filer, Visifile, Apple Works, Microsoft Works, dBase 4), and business graphics e.g., Easy Graph, Graphic Department, Alpha Chart, Lotus, Wings, Quattro)
- Computer system (e.g., Apple II, IBM, Macintosh)
- Printer (e.g., dot matrix, laser)

Activity Procedures

Word Processing

1. Select a topic from the list below:

- a safety rule
- an industrial arts club event
- a test question a study thinks will be on the test
- instruction regarding how to use the printer or other piece of equipment
- what students are learning about computers in industrial arts class (make this one to a school board member, to the administration, or to other teachers)
- a management function in a student enterprise
- a piece of school equipment needing service (fixing, oiling, sharpening, cleaning, etc.)
- a new class policy (clean-up, first aid, reporting broken equipment, make-up work, etc.)

2. After receiving instruction, use a simple word processing program to prepare a short memo to address the topic.

3. Use the following format to prepare the memo:

TO: _____
FROM: _____
DATE: _____
REGARDING: _____ (Topic chosen)
Content of the memo _____

Databases

1. Select one of the following problems

- Prepare a database for stockholders in a student enterprise. Include the amount of stock each person purchased.
- Prepare a database for a student organization. Include the amount of dues paid.
- Prepare a database listing your assignments for the past four weeks of your Technology Education class. Be sure to include the scores you received on each assignment.
- Prepare a database of players on one of the school's sports teams. Depending on the sport, include things like total points, total yards gained, RBI's, times at bat, free throws shot, etc.

- Prepare a database of the students in class. Indicate the total number of days they missed over the past month.
- 2. After receiving instruction, use a simple database program and enter the information.
- 3. Once entered, sort and print the information as follows:
 - by last name in alphabetical order
 - from highest to lowest amounts of scores, grades, money owed, etc.

Spreadsheets

Based on the previous activity, complete the appropriate task.

- Determine or forecast the profit margin for a student enterprise
 - Determine the financial status for a student organization (e.g., Technology Student Association, VICA)
 - Determine your grade point average for assignments completed over the past four weeks.
 - Determine various statistics, (e.g., points scored, total yards gained, number of rebounds, free throw percentages, RBI's, batting averages, aces) for a school team sport.
 - Determine the percentage of students absent from class on a given day.
2. After instruction, use a spreadsheet to process the information and solve the problem.
 3. Be prepared to discuss your results with the rest of the class.

Business Graphics

1. Using the information created during the previous two activities, prepare a graphic that can be used to visually interpret and analyze the information.
2. After receiving instruction, use a business graphic program to prepare a chart or graph of information.
3. Be able to discuss your results with your classmates.

Activity Analysis

1. Explain how computer assigned information management systems can be used to increase the productivity of office personnel.

2. List and describe five applications for information management systems.

1.

2.

3.

4.

5.

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WORD PROCESSING

SUPPLEMENTARY MANAGEMENT INFORMATION ACTIVITY

Introduction

The invention of the modern tool called the computer came about because of overwhelming growth of information that was generating volumes of data, greater than anything before, during or after World War II. The first computer was the size of a very large room and processed information slowly by today's standards. The common computer today is composed of three main types of hardware. They are an input device (keyboard), a central processing unit (CPU), and an output device (monitor or printer).

Hardware describes the physical equipment needed to make computer processing possible, whereas the software describes the programs that run the program.

Word processing is a software program used in a computer that allows it to process text material. Text materials may be in the form of creative writing, news articles, newspapers, letters, etc. A computer with a word processing program replaces your typewriter and it provides an electronic way to create, store, revise, and print text material. It is said that with the use of a word processor a person's productivity in writing will double.

To start working with any word processing program, a person will first need to obtain a blank disk for the type of computer they are using. This blank disk will have to be formatted before it can be used. Formatting means to initialize the disk so that the computer can recognize where to start adding or subtracting text material. Script is the text material that a person may type into the computer. After inputting script, many times it has to be edited. This is a process of proofing the script, adding new or deleting material. By giving commands that are unique to the word processing program used, the original script or parts of the script may be moved to another area. This allows for rearranging of material without retyping. Finding is another function that can be used to search through the script to find certain words or phrases.

Most word processing program will have a companion program that will allow the individual user to check for proper grammar, spelling, or style. This process allows the script to be improved and upgraded for other uses in the future. These word processing programs, along with other added features, increase efficiency and productivity of the human race.

Materials and Supplies

- Computer
- Keyboard
- Monitor
- Printer
- Word processing program
- Printer paper

Problem Statement

Problem Statement

In this activity, you will write a short news article. The article should describe how computers are being used in your Technology Education class.

Problem Solving Assignment:

1. Review all materials that your instructor presented to you in class.
2. Talk to your instructor to get a better understanding of the news article that you have been asked to write using the computer. (See if the instructor has any photographs of the laboratory activity you are writing about.)
3. Check with your instructor or the school newspaper editor on the maximum length of such a news release.
4. Obtain a disk from your instructor or bring one from home to use in the computer.
5. Turn on the computer and insert or call up the word processing program. This will allow you to write your article.
6. Format the blank disk so that your article can be stored.
7. Start keyboarding your article into the computer. When you are done, print the script on a piece of paper. (This is referred to as hard copy.)
8. Pair up with another student and read their script and have them read your script. Discuss the good and bad points. (Take notes about additions or corrections to your article.)
9. Use the computer to call up your program. Using the commands given to you, make any corrections or additions needed to complete the assignment. (Use the spell and grammar check programs that were demonstrated to you.)
10. After completing the assignment, make a hard copy and hand it into your instructor. If possible, share your work with the school newspaper.

Activity Analysis

1. A computer contains three parts. They are:
 - A. Keyboard, computer, and CPU
 - B. CPU, keyboard, output device
 - C. Monitor, printer and CPU
 - D. None of the above.
2. The material or program that goes into a computer in the form of a disk is referred to as _____.
3. When a person starts with a new computer disk, the disk should first be _____.
 - A. edited
 - B. deleted
 - C. saved
 - D. formatted
4. What is the function of a spell check program?
5. When you are correcting some typed copy, you are _____ the script.

6. When you want to keep the typed material for a period of time, you use the _____ function to place it on a disk.
7. Which one of the following items are called hardware?
- A. word processing program
 - B. spell checker
 - C. grammar checker
 - D. CPU
8. Word processing programs are used by what type of business?
- A. newspaper
 - B. magazine
 - C. lawyer
 - D. All the above
9. Define and explain the following terms:
- A. format disk
 - B. edit
 - C. save
 - D. print
 - E. delete
 - F. move
 - G. find
 - H. replace

ELECTRONIC PUBLISHING

Publishing newspapers, magazines, books and documents requires a lot of information processing. Before computers, this information had to be processed manually. Writers created their text on typewriters. An editor had to read the typewritten copy and pencil in corrections and refinements. The edited copy was sent to a typesetter who entered the information into a typesetter. The typesetter produced copy that could be photographed. Layout people would have to cut and paste copy, headlines, and photographs and the negatives were used to make printing plates. The plates containing the information were mounted on printing presses and the final product was produced. Distributing the final product was often limited to the U.S. Postal Service or private distribution services. The use of computers in the graphic arts industry have made these steps easier and faster. In addition, computers have introduced new ways of moving information through the printed word.

The application of computers in publishing is called "electronic publishing." Electronic publishing is basically storing, accessing, and processing information with electronic communication technology. Information is stored in a central computer and delivered to the user through a telecommunication system.

Using electronic publishing, you can access information stored in a central computer source called a data base. A data base is like an electronic library you can visit through your phone line and computer. Data bases typically contain up-to-date information on topics like medicine, industry, agriculture, science, and education. In order to gather specific information about a topic, a writer performs what is called "computer searches." A computer search is like looking through a card catalog, finding the book you need, and being able to read it without leaving your computer. Best of all, a computer search only takes a fraction of the time it takes to find information manually.

Once information has been gathered electronically, it can be combined with new information electronically through word processing. Word processing enables a computer to act like a typewriter. However, a word processor can do a lot more than a typewriter. It allows the writer to enter text, erase mistakes, move sentences, move paragraphs, check spelling, and much more. In addition, the information can be stored electronically. When the information needs editing, it can be retrieved from storage and all the modifications can be made electronically.

With some electronic publishing systems, illustrations and pictures can be converted into an electronic form. In this new form, they can be combined with the text.

During composition (putting it all together in an organized form) both pictures and text can be moved around and changed so each page looks nice. During a final editing stage, the computer is used to correct errors, delete copy, insert copy, and organize the materials. After final editing, the information is stored electronically again.

Preparing copy for reproduction (printing) is called typesetting. In electronic publishing, the typesetting is also performed electronically. Information is accessed from storage and typesetting codes are added. These typesetting codes tell the typesetter things like what type size and style to use. After typesetting, the information can be stored, used to

produce the finished product locally, or mailed electronically to distant locations. Mailing the information means sending it through a telephone line, microwave link, or satellite to a new location. At the new location, the information can be printed or displayed for the consumer.

Large scale electronic publishing is being used by large newspapers and news magazines. With electronic publishing technology, the publishers can send their latest edition to various parts of the United States electronically. The newspaper or magazine may be designed in one location, but it is printed and distributed in several locations. Large business form manufacturers and book publishers also use forms of electronic publishing.

Electronic publishing technology in its smallest form is called "desktop publishing." With desktop publishing, personal computers, printers, and special software are used to produce high-quality professional looking documents. With desktop publishing, a company only needs to produce as much printed material as they need. Since the information is stored electronically, if they need more copies, they can access the stored information and print as many as they need. Using an outside company for printing documents is expensive and time consuming.

The use of computer in the graphic arts industry means we have access to more information than ever. In addition, the cost of information has been reduced.

Problem Statement #1

Your student enterprise, Bright Ideas, Inc., is manufacturing picture frames. They have been designed to accommodate prom pictures. The target market is the junior and senior class. Your task is to electronically compose a one-page advertisement that can be put in the school newspaper. The advertisement needs to include a slogan promoting the product and clip art to catch the reader's eye. In addition, the advertisement needs to announce the product's price (\$3.00) and where they can be purchased (the school bookstore).

Materials and Supplies

- Plain paper
- Software package (e.g., The Print Shop, Dazzle Draw, Signmaker)
- Computer system (e.g., Apple II, IBM, Macintosh, Commodore 64)
- Compatible printer (e.g., Imagewriter, Epson, etc.)

OPTIONAL: Many software packages are supported with graphics library disks containing various examples of clip art. The clip art can be used to enhance advertisements.

Activity Procedures

1. In groups of two, review the information detailed in the Problem Statement.
2. Begin by sketching several possible graphic illustrations which are appropriate for the ad.

3. Next, prepare appropriate copy for the ad. Remember the ad should be eye catching, short, easy-to-read, and in good taste.
4. As a group, select the layout that best addresses the problem. You may have to take several designs in order to get the best one.
5. Once selected, prepare a refined sketch and show the ad to your instructor.
6. After being approved by your instructor, produce the ad.
7. After receiving instructions on how to use the software and computer hardware, recreate your ad using the computer.
8. Once complete, print the ad. Show the ad with your instructor.
9. Be prepared to discuss your group's design with your classmates.

Activity Analysis

1. Identify three areas of the print media where computer graphics are being produced using a computer.

- a. _____
- b. _____
- c. _____

2. List three advantages of computer-generated graphics.

- a. _____
- b. _____
- c. _____

Problem Statement #2

Your class is publishing an industrial education newsletter. It will be mailed to the members of your school community. The newsletter will feature stories about your class. Your role will be to create a banner. You will also write a story about how your class uses microcomputers to learn about computer applications in industry.

Materials and Supplies

- Electronic Publishing Software (e.g., The Newsroom, Publish It, DTP Advisor, Print Shop Companion).
- Compatible computer system (e.g., Apple II, IBM, Commodore 64).

- Compatible printer (e.g., Imagewriter, Epson).

Activity Procedures

1. In groups of two, review the information detailed in the problem statement.
2. Then begin by preparing copy for the article and creating or selecting graphics. This can be achieved by dividing the responsibilities. For example, one group member could generate the text, while the others create the appropriate graphics.
3. Once complete, share with your instructor.
4. After the information has been approved, the next step is to prepare the page layout.
5. After receiving instructions on how to use this computer system and software, prepare a newsletter banner and lay out the article.
6. Once complete, carefully edit the article. Make modifications as needed.
7. Once satisfied, create a hard copy by printing the file.
8. Show the ad with your instructor.
9. Be prepared to discuss your group's design with your classmates.
10. Once finished, group the completed articles into a booklet and send a copy to parents, school board members, etc.

Activity Analysis

1. Identify three areas of the print media, where electronic publishing is being used to generate and format copy.
 - a. _____
 - b. _____
 - c. _____
2. List three advantages of generating copy using electronic publishing technologies.
 - a. _____
 - b. _____
 - c. _____

COMPUTER-AIDED DESIGN/DRAFTING

Introduction

Every product we buy requires information processing. Until recently, most information processing was done manually. Before a product could be produced, a lot of drawings and calculations had to be made. Today, computers are often used to help design products. Instead of using a pencil and paper, the designer uses a computer to record and process their ideas. Designing a product with the help of a computer is called "computer-aided design" or CAD. A CAD system has three basic parts: hardware, software, and users.

A CAD system has three basic applications. The first application is called mathematical modeling. Let's say a designer is developing a new airplane. The designer enters design ideas by drawing a picture on the computer. Inside the computer the information is converted into a set of numbers that represent the airplane. This group of numbers is a mathematical model of the airplane. The designer can see the mathematical model on the monitor in the form of a picture. Since the airplane design is really a set of numbers, it can be changed. Using computer commands, the designer can tell the CAD system to rotate the airplane. If the designer needs to see a small part of the airplane, another command can be used to "zoom" in on a small part of the design. Using other commands the designer can cut away sections and look at a cross section of the airplane. The mathematical model of the airplane can be stored on disk, used to program machines, change inventory records, and much more.

The second application for a CAD system is called engineering analysis. Because the design is basically a group of numbers, the computer can help perform calculations. Using a few commands, for example, the designer can determine things like the amount of materials needed to make the product, the cost of the product, and the weight of the product. In addition, the designer can use the mathematical model to simulate how the design will perform under real conditions. For example, a real payload can be put into a truck design. Using the simulated load, weakness in the truck's frame can be identified right on the screen.

Lastly, a CAD system can be used to produce drawings of the product. Unlike conventional drafting, design changes can be made quickly. Using conventional drafting methods, design changes often mean drawing a new set of plans. With a CAD system, the designer simply enters the needed modification in one view of the drawing and the computer automatically makes the required changes in other views. Once all the changes have been made, the computer can make a new set of drawings in minutes.

By using CAD, automobile manufacturers can redesign an automobile in almost half the time it took with conventional methods. When designers use a CAD system, they can spend more time creating and solving problems. The boring and time consuming parts of drafting are performed by the computer. The accuracy, flexibility, and efficiency make computer-aided design and drafting one of the most valuable tools in industry.

Materials and Supplies

- Access to a computer system (e.g., IBM, Apple II, Macintosh, Commodore 64)
- Compatible CAD software (e.g., CADDraw, Auto Sketch, Cad ????, Car Builder, Model Rocket Designer)
- Access to a printer or plotter
- 1/4" grid paper (11" x 14 sheets)

Activity Procedures

1. In groups of two, select one of the problems stated below.
 - Design a floor plan for a hunting cottage. Include two exits, a sleeping area, kitchen, and a full bathroom.
 - Design a two-way (woofer and tweeter) book shelf speaker.
 - Design a custom model rocket. Include fin, nose cone, and decorative designs.
 - Design a model car that is powered by a CO2 cartridge.
 - Make your design as aerodynamic as possible.
 - Design a device that hangs inside a locker and holds pens and pencils.
 - Design a desk top container that will hold computer disks. Your design needs to use a material other than metal.
 - Design a device that would display business cards on a desk.
2. Using graph paper, create several sketches which solve the problem.
3. As a group, select the best design. Parts from several may be combined to create one good design. Once complete, show the design to your instructor.
4. After receiving instructions on how to use the software, use the CAD system to solve the problem.
5. Once finished, check to see that your design team has completed the problem.
6. Once complete, print your design and be prepared to discuss with your classmates.

Activity Analysis

1. Describe three basic CAD applications?

2. In what ways can a CAD system improve a typical manufacturing enterprise?

ROBOTICS

Introduction

The robots you have seen in science fiction movies really have very little in common with industrial robots. "An industrial robot is a reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions for the performance of a variety of tasks" (Robotics Industries Assoc., 1985). More simply put, an industrial robot is a machine that can be taught to perform an industrial task. Since robots play an important role in production process, they are considered part of the CAM (computer-aided manufacturing) system.

Industrial robots have three basic parts; a manipulator arm, a controller, and a power supply. The manipulator arm is the part that actually does the work. The manipulator arm, like a human arm, includes joints and an "end effector." The end effector acts like a human hand. It can have two or three gripper-like fingers that can pick up parts or a chuck (holder) for a specific tool.

The controller, the robot's brain, is basically a computer. Robots are not programmed like most computers. Programming a robot is called "teaching." Most robots have a controller that includes a teach pendant. The teach pendant is a hand held box with buttons on it. Each button represents a function the robot can perform. To teach a robot to perform a given task, a technician uses the teach pendant to have the robot act out the task. While the robot is acting out the task, each step it takes is being stored in the memory of the controller. Once the robot has been taught a task, it can perform the task over and over again automatically.

The power supply provides the power for the manipulator arm. It can either be electric, hydraulic, or pneumatic. The power supply acts like the robot's heart and muscles. It provides the energy for pushing, pulling, turning, and lifting.

Industrial robots are an extension of a human being in much the same way as a hammer is; they are both tools that help us be more productive. A hammer makes driving a lot of nails in a short period of time possible. Robots make welding a lot of cars on an assembly line possible. Neither a hammer or a robot will work without people. Without the craftsman, a hammer uses up space and collects dust. Without a technician, an industrial robot is just as useless. Robots, like computers, are dumb. They have to be taught every step in order to perform a task. No one should have to drive nails without a hammer. It would be very difficult and dangerous. Basically, robots do jobs people should not have to do. They perform tasks that are typically dull, dirty, and/or dangerous. For example, welding and painting are jobs often performed by robots on automobile assembly lines. In both cases, the job involves repetitive tasks, requires protective clothing, and produces fumes that are hazardous to people. It is appropriate for a robot to do these jobs.

Industrial robots are used for three basic types of jobs. The first one is materials handling. Robots can be used to load and unload machines automatically. They can also be used to move materials from one work station to another. At the end of an assembly line, robots can be used to put finished products in packages. Lastly, robots can be used to put large and/or heavy products on pallets (a movable platform for a fork lift).

Tool operations are the second basic type of task performed by industrial robots. These tool operations include things like welding, drilling, cutting, painting, deburring, testing and inspection.

The last basic type of task performed by industrial robots is assembly. Most assembly tasks are too complicated for robots to perform. However, simple and repetitive assembly jobs can be done by a robot. One common application for robotics in assembly is inserting electronic components into printed circuit boards.

Industrial robots typically increase production capability, improve product quality and lower production costs. They do not get sick, they do not get bored, and they can work 24 hours a day without a break. Industrial robots allow people to spend more time doing what they do best, thinking.

Automated Guided Vehicle

Materials and Supplies

Each group of two or three will need the following materials:

- One mobile programmable robot (e.g., WOA)
- Access to a scale model of a plant layout for a given product. (For this activity, a memo pad holder will be used.) (DR #1)
- Flow process charts for the given product (SH #1)
- Plant layout showing the proposed materials-handling routes (optional) (DR #2)

Problem Statement #1

You are a member of the engineering department for Memo, Incorporated. Management has recently decided to automate the plant's materials-handling systems. Because of the facility layout, the plant has been divided into two separate routes. Your division has been assigned the task of programming an automated guided vehicle (AGV) for one of the materials-handling systems routes (your instructor will assign the route).

Activity Procedures

1. Each group should obtain the materials necessary to complete the activity.
2. As a group, study the flow process chart and scale model.
3. Using the mobile programmable robot, teach the robot the desired route.
4. Once your team has programmed the AGV, test it using the scale model.

5. If the AGV does not complete the route as planned, make necessary changes or modifications.

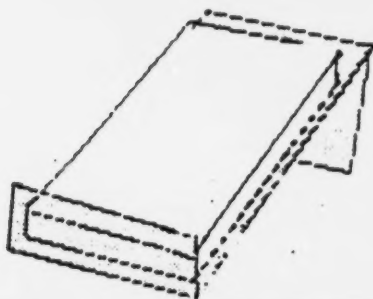
Activity Analysis

Based on the experience gained by conducting this activity:

1. What are the advantages of using computer-controlled AGV's in a manufacturing facility?

2. What are the disadvantages of using computer-controlled AGV's in a manufacturing facility?

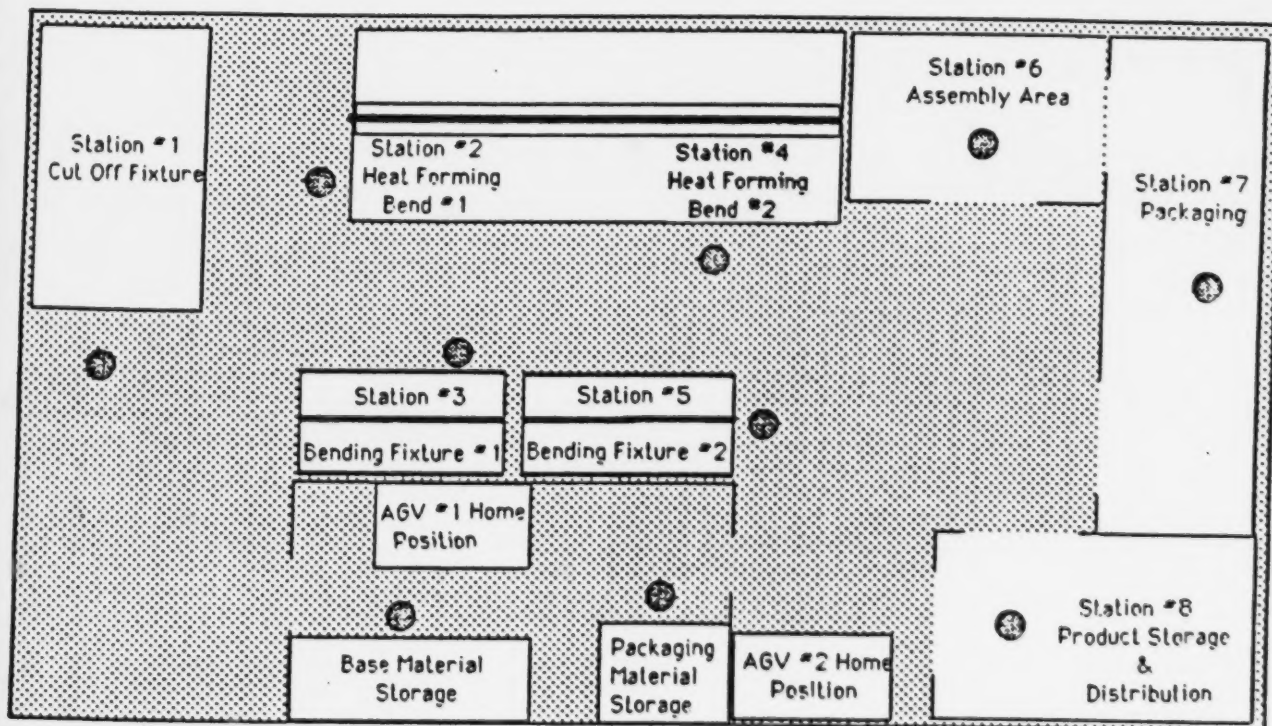
3. What role does the computer play in this activity?

FLOW PROCESS CHART
FOR MEMO HOLDER

PROCESS SYMBOLS AND NO. USED		☐ OPERATIONS <u>5</u> ☐ INSPECTIONS <u>0</u> ☐ TRANSPORTATIONS <u>7</u> ☐ DELAYS <u>3</u> ☐ STORAGES <u>0</u>		
Task No.	Process Symbols	Description of Task	Machine Required	Tooling Required
1	○ → □ D ▽	MOVE TO BASE MATERIAL STORAGE	AGV-1	—
2	○ → □ D ▽	LOAD BASE MATERIALS	—	—
3	○ → □ D ▽	TRANSPORT MATERIALS TO STATION #1	AGV-1	—
4	● → □ D ▽	CUT BASE TO LENGTH		CUTOFF FIXTURE
5	○ → □ D ▽	TRANSPORT BASE TO STATION #2	AGV-1	—
6	● → □ D ▽	HEAT BASE FOR BEND #1	STRIP HEATER	—
7	○ → □ D ▽	TRANSPORT HEATED BASE TO STATION #3	AGV-1	—
8	● → □ D ▽	BEND BASE		BENDING FIXTURE #1
9	○ → □ D ▽	DELAY UNTIL COOL		
10	○ → □ D ▽	TRANSPORT BASE TO STATION #4	AGV-1	
11	● → □ D ▽	HEAT BASE FOR BEND #2	STRIP HEATER	
12	○ → □ D ▽	TRANSPORT HEATED BASE TO STATION #5	AGV-1	
13	● → □ D ▽	BEND BASE		BENDING FIXTURE #2
14	○ → □ D ▽	DELAY UNTIL COOL		
15	○ → □ D ▽	RETURN TO HOME POSITION	AGV-1	

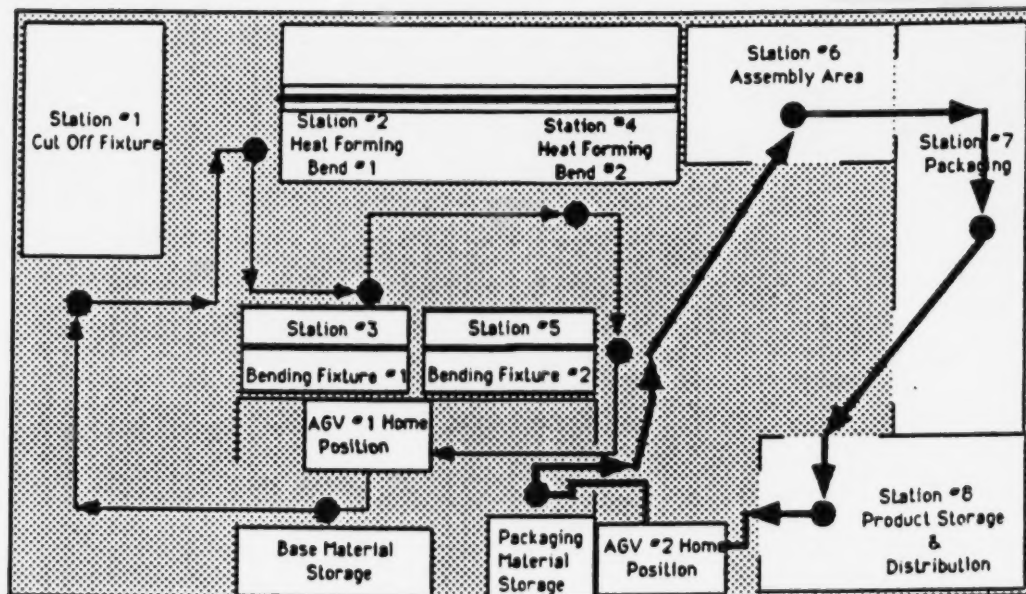
PROCESS SYMBOLS AND NO. USED		○ OPERATIONS <u>2</u> □ INSPECTIONS <u>2</u> ◡ TRANSPORTATIONS <u>6</u> D DELAYS <u>2</u> ▽ STORAGES <u>1</u>			
Task No.	Process Symbols	Description of Task	Machine Required	Tooling Required	
16	○ ◡ □ D ▽	MOVE TO PACKAGING MATERIAL STORAGE	AGV-2		
17	○ ◡ □ D ▽	LOAD MATERIALS	—	—	
18	○ ◡ □ D ▽	MOVE TO STATION #5 AND PICKUP BASE	AGV-2		
19	○ ◡ □ D ▽	LOAD BASE			
20	○ ◡ □ D ▽	MOVE TO STATION #6	AGV-2		
21	○ ◡ □ D ▽	INSPECT BASES			
22	● ◡ □ D ▽	FASTEN PADS TO BASES	GLUE		
23	○ ◡ □ D ▽	MOVE TO STATION #7	AGV-2		
24	● ◡ □ D ▽	PACKAGE THE PRODUCT	STAPLER		
25	○ ◡ □ D ▽	MOVE TO STATION #8	AGV-2		
26	○ ◡ □ D ▽	FINAL INSPECTION			
27	○ ◡ □ D ▽	STORE FINISHED PRODUCTS			
28	○ ◡ □ D ▽	MOVE TO HOME POSITION	AGV-2		
	○ ◡ □ D ▽				
	○ ◡ □ D ▽				

Sample Plant Layout



AGV Loading
& Unloading
Locations

Sample AGV Routes



- AGV Loading & Unloading Locations
- AGV Route #1
- AGV Route #2

Robotics/Computer Programmed

Materials and Supplies

Each group of two or three will need the following materials:

- (1) programmable robotic arm. Listed below are potential sources:

Paxton/Patterson
5719 West 65th St.
Chicago, IL 60638

Hearlihy and Co.
P.O. Box 869
714 W. Columbia St.
Springfield, Ohio 45501
1-800-622-1000

TransTech Systems
Div. of Creative Learning Systems, Inc.
9889-E Hibert Street, Suite C
San Diego, CA 92131
1-800-458-2880

Career Aids, Inc.
20417 Nordhoff St., Dept. S4
Chatsworth, CA 91311

Aidex Corporation
1802 N. Division St.
Morris, IL 60450
1-800-251-9935

Microbot, Inc.
453H Ravendale Dr.
Mountain View, CA 94043

Modern School Supplies
P.O. Box 958
Hartford, CT 06143
1-800-243-2329

Pitsco
P.O. Box 1328
Pittsburgh KS 66762
1-800-835-0686

Rino Robotics, Inc
2505 South Neil
Champaign, IL 61820

(TEACHERS NOTE: The cost can range from a few hundred dollars to several thousand dollars, so it is important to shop around to obtain the equipment that will work best for you and your students. It is also important to note that this activity can be modified so that low cost robotic simulation software (e.g., Robcat) can be used to replace the more expensive computer-controlled arms. Remember it is the concept of computer applications (in this case the computers role in controlling industrial robots) that is important and not so much the specific activity used to reinforce this concept.

- Access to a compatible computer system (e.g., Apple II, IBM, Macintosh)
- Access to scaled mock-ups (DR #3) of various machines (e.g., lathe, conveyer)

Problem Statement #2

Mag Peg, Inc. is in the business of producing board pieces for various games (e.g., Tic-Tac-Toe, Checkers, IQ Tester). The company is in the process of reorganizing and automating the wooden peg division. This will require part of the line to include an automated work cell. The work cell will utilize a robot, two conveyors, and lathe. As an engineer for the company it is your job to set up the work cell and program the robot to perform the following operation:

The robot should be programmed to take the material off of the in coming conveyor, place it in the lathe, back off for ten seconds, pick up the finished piece, and place the finished piece on the out going conveyor. The robot should be able to repeat this process five times (see DR #4 for sample before and after game peg pieces).

Activity Procedure

1. After receiving instructions from your teacher on how to use the robotics system and software, arrange the conveyors, lath, and robot according to DR #5.
2. Once arranged, prepare a program that will cause the robot to perform the task as described above.
3. After entering the program into the computer, test it. To make the simulation more realistic, replace the blank unfinished piece with a finished piece during the ten second delay. The ten second delay represents the machining operation. Since this is a simulation, this operation should be done by you.
4. Modify the program as needed and retest.
5. Once all the bugs have been worked out, demonstrate the program to your instructor and classmates.

Activity Analysis

Based on the experience gained by conducting this activity:

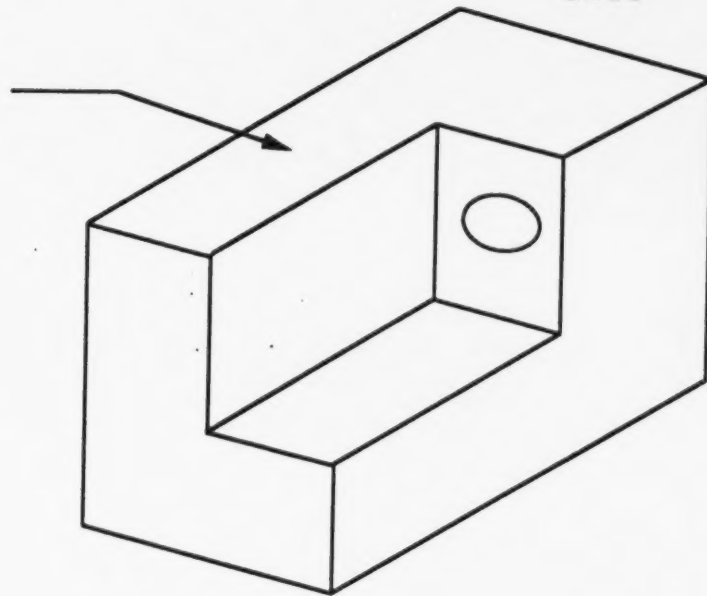
1. What are the advantages of using computer-controlled robots in a manufacturing facility?

2. What are the disadvantages of using computer-controlled robots in a manufacturing facility?

3. What role does the computer play in this activity?

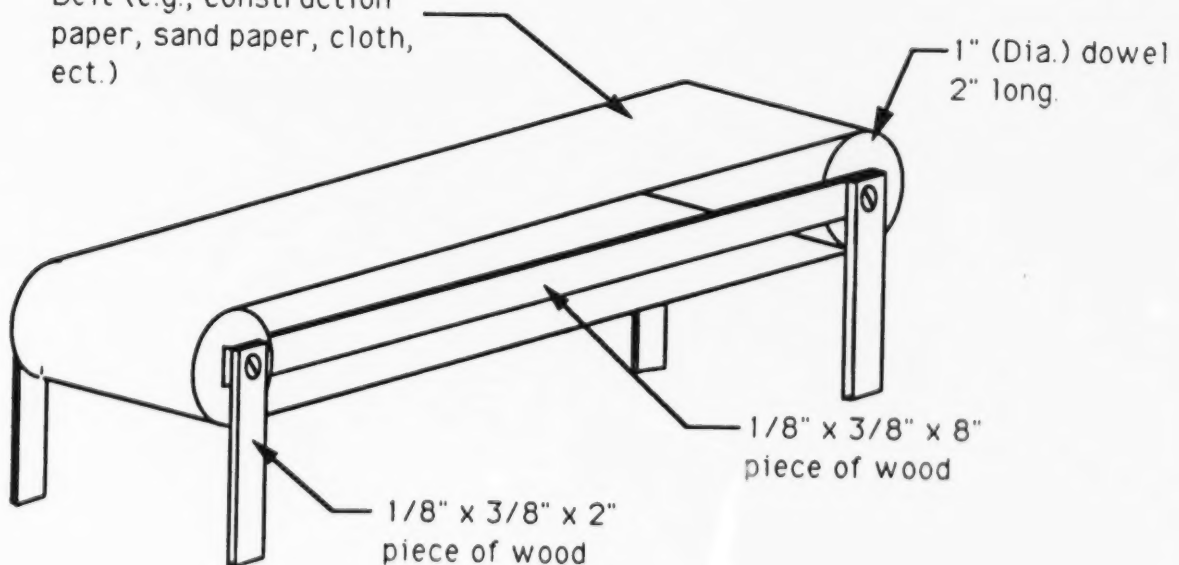
DR #3

A 3" x 3" x 5" block of wood with a 1 1/2" x 1 1/2" x 3" notch cut out of one corner. There is also a 5/8" (Dia.) hole, 3/4" deep at the end of the notch.



SAMPLE LATHE MOCK-UP

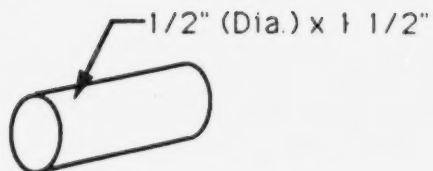
Belt (e.g., construction paper, sand paper, cloth, ect.)



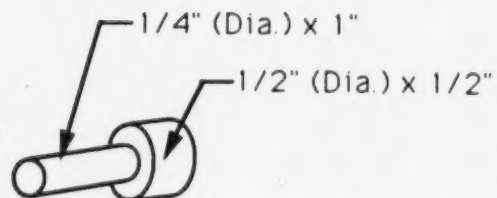
SAMPLE CONVEYOR BELT MOCK-UP

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DR #4

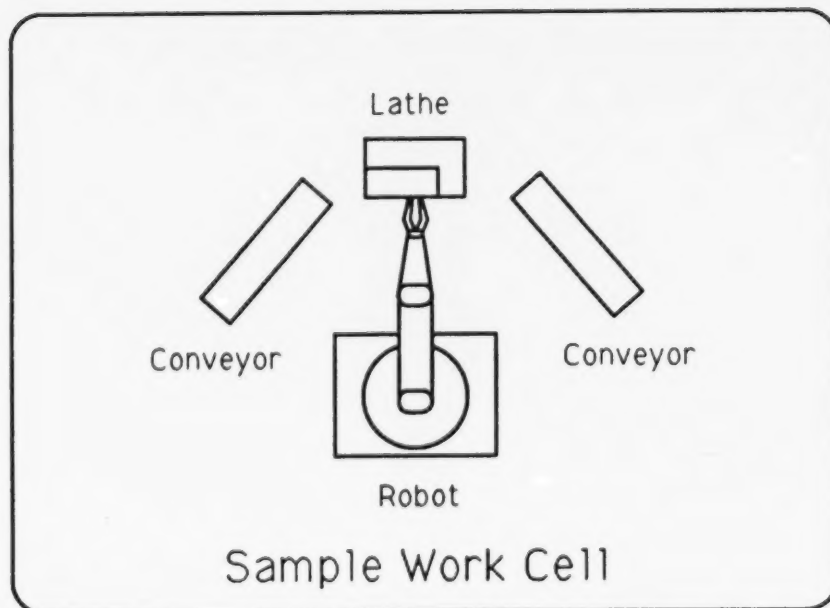


Blank Dowel



Finished Game Piece

DR #5



61-C

COMPUTER IMAGING

Introduction

Many professionals such as engineers, artists, animators, designers, and illustrators rely on images to communicate ideas. Until a few years ago, the images were created using various graphic and drawing tools. Today another tool, the computer, is revolutionizing the imaging field. Computer imaging combines hardware and software to input, process, and output images.

Explaining how computer imaging works can be done using communications models (see Figures 1 and 2). The process begins by inputting images into the computer with an input device such as a video camera or electronic scanner. The video camera can capture three-dimensional analog images and converts them into two-dimensional digital images. An electronic scanner captures two-dimensional images. By using a mouse or digitizing table, images can be created and the signal brought into the computer.

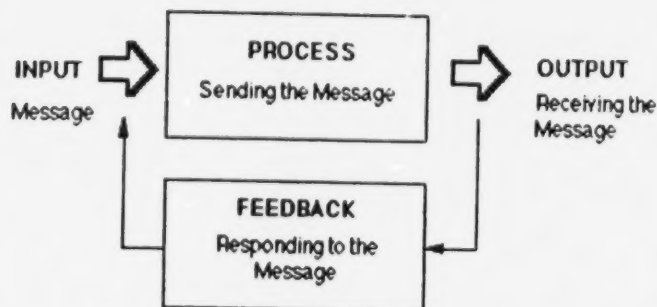


FIGURE 1

No matter the input device used, it must be connected to a computer system. The computer or central processing unit (CPU) receives and processes the signal. The computer processes the signal with the aid of software. Software is a set of instructions which tell the computer what to do. Imaging software allows the user to change, enhance, edit, copy, modify, resize, animate, and add text. The type of software used will determine how much editing can be done to the image.

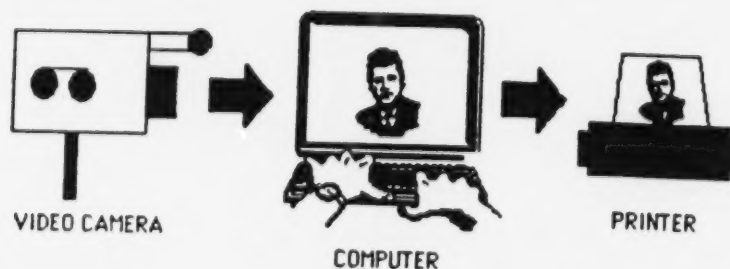


FIGURE 2

Once changed, the image can be displayed in hard copy form by using an output device which includes printers, plotters, negative processors, and typesetters, just to name a few. Or, the image can be stored for later use in a document, newspaper, or magazine ad. It can also be used in an animated cartoon to be viewed on television or read in a comic book.

There are many applications for computer imaging architects and interior designers can create computer generated drawings (CAD) and then change various elements such as walls, doors, windows, beds, tables, and chairs at will. Illustrators and advertisers can touch-up and enhance illustrations and photographs. National Geographic, for example, recently showed a picture of the Egyptian pyramids on the cover of its magazine. In order to make the cover look more balanced, one of the pyramids had to be altered electronically and moved closer to the others. Photographers, illustrators, and television advertisers can alter and modify images to fit their needs. A model's hair color can be changed from red to blond. Black and white film can be colorized. A picture of an automobile can be removed and combined with a picture of an island in the middle of the ocean, all without leaving the computer.

In addition to traditional communication-related industries, the medical and science communities are using computer imaging techniques to enhance their work. Computer imaging is used by pediatricians to track the development of unborn children and cosmetic plastic surgeons to show patients what a "face lift" or "tummy tuck" may look like if the operation is done.

With computer imaging techniques and advancements growing so rapidly, no longer can you say "a picture never lies," thus raising many ethical questions. How far is too far? When is an original picture altered enough to become somebody else's work? Is it right to change images in order to trick the public into believing the image is original? As imaging technology moves forward, what other questions will arise?

In this Technology Education Activity, you will experience computer imaging by importing an image into a computer system, modifying it and incorporating the image into print advertisement.

Materials and Supplies:

- One or more computer imaging input devices:
 - a. video camera input device (e.g., MacVision, Computereyes/2 [Apple II series & IBM series computers]).
 - b. scanner input device (e.g., Thunderscan, flatbed, vertical, hand-held)
 - c. image generating software (e.g., Print Shop, MacDraw, Art Studio, Publish It, Autosketch, computer clip art)
- Processing devices:
 - a. computer system (e.g., Apple II series, IBM, Macintosh)
 - b. imaging editing software (e.g., Print Shop, Newsroom, MacPaint, Image Studio, Art Studio, PC Paintbrush)
- An output device (e.g., dot matrix printer, laser printer)

Problem Statement:

As a member of *Print It Advertising Agency*, it is your job to prepare print ads for various clients, which involves combining graphics from two or more sources, touching-up and enhancing pictures, modifying drawings, and inserting text. The department manager has recently received several new clients and has assigned you the task of creating a print ad for one of them.

Activity Procedures:

1. In groups of two, select one of the clients from the list below:

A local environmental group wants an ad to promote a new recycling program for the community. The program encourages area residents to separate their garbage into various recyclable categories, for example, all paper products in one container, glass bottles in a second, plastic in a third, and lawn clipping in a fourth. The ad should contain images and text supporting this idea and theme.

A local car dealer is running the following promotion: Buy an in-stock car by the end of the month and receive a free seven day trip to Hawaii. The dealer wants the ad to reflect the sale of cars and the free Hawaii vacation.

The area mall is wanting to promote an upcoming sidewalk sale. All the mall merchants have decided to combine their efforts to buy the ad. Since all merchants are participating, the ad should reflect the event and the mall in general and not anyone specific store.

2. Once selected, sketch several possible solutions. As a group, select the best design. Remember, several good ideas can be combined to create one design. When evaluating the designs, be sure each ad adheres to the following guidelines:
 - a. simple and easy to read
 - b. in good taste
 - c. representative of the product or ad theme
3. Next, you must select and generate graphics. Begin by having your instructor show you how to use the computer, software, scanner, video camera, etc. available at your school. Import the image or images needed to meet the needs of the client. Next, modify the image, including combining one image with another, making the image larger or smaller, and/or adding or deleting details.
4. After the graphics have been input, prepare copy. The copy and text should support the theme or idea of the topic.
5. Once the copy and graphics are finished, use the software provided to develop an ad layout. Remember, the ad should follow the guidelines stated above. In order to make the ad look right, further modifications might be required to the text and image. Once complete, save your work.

6. To complete the process, use a printer (dot matrix, laser, etc.) to generate a hardcopy of the ad. Be prepared to share your design with classmates.

Activity Analysis

1. Identify and describe three current application for computer imaging?

a. _____

b. _____

c. _____

2. Identify and describe three future application for computer imaging?

a. _____

b. _____

c. _____

3. Explain how computer imaging works?

BAR CODING

Introduction:

When you are in the grocery store, stop and look around. There are thousands of products on the shelves of most grocery stores. How do the people who work at the store keep track of all of those products?

People in all kinds of work have struggled for many years to keep accurate records of the products on their shelves. In recent years this struggle has been made easier by the increased use of **bar coding**. Bar coding is a method of identifying products for one of many reasons. It is a system which uses bars and spaces of varying widths to represent a letter (alphabetical) or number (numerical) code. The bars and spaces are read by a laser which converts the information into digital form so it can be communicated to a computer.

There are many different bar coding schemes. Some schemes represent only numerals, while others represent both letters and numbers. But all schemes use binary code sets, known as ciphers, to represent letters or numbers. The binary code ciphers, which are a series of ones and zeros, represent the widths of the bars and spaces. For example, the number one represents a bar, and a zero represents a space. The bars and spaces are equal widths. So, if there are two bars in a row, you have two ones (1) in a row. If the cipher representing the number nine (9) reads 1011001, then the bar code would have a single bar, followed by a single space, followed by two adjacent bars, followed by two adjacent spaces, and ending with a single bar (see Figure #1).



FIGURE 1

Bar coding uses a simple system where information is input, then processed and a result is output. A bar code reader is used as the input device. A bar code reader has neon laser that reads the code. The code is then sent to a computer as an electronic signal. The computer then processes the signal. It uses a computer program that tells it what process to perform. For example, the computer may determine the cost of the item, and/or how many of that item are left in inventory. This information is then output. The price is output to the cash register, which prints the price, and the inventory information is output to the computer that does the ordering of new stock.

Bar coding can be applied to anything where the identification of an object is necessary. Just as the grocery store uses bar codes to identify the price of an item, or a warehouse uses them to keep an accurate inventory, you can use bar codes to identify any object for a variety of reasons.

In this Technology Education Activity you will choose or be assigned a problem to solve. The problem is solved by applying the concepts that you learned during the bar coding lesson.

Materials and Supplies

- Bar coding reader and software (e.g., Kelvin Electronics, 7 Fairchild Ave., Plainview, New York 11803)
- Compatible computer system
- A printer (e.g., dot matrix, laser)

Activity Procedures

1. In groups of two, select one of the following problems:
 - Design a method to keep an accurate record of software disks that are checked in and out of the school's computer lab.
 - Design a method of keeping track of consumable supplies in the school's office.
 - Design a method of keeping track of student completion and progress on various course assignments.
 - Design a method of keeping track of student attendance.
 - During a process-based activity (e.g., making a newsletter, a mass produced product), design a method of keeping track of each phase of the product's development.
2. Once your group has selected the problem, begin to analyze how the bar coding concepts may be applied to solve the problem.
3. After receiving instructions on how to use the bar coder and related hardware and software, use the equipment to design a method for solving the problem.
4. Once completed, test the solution. Modify the program as needed.
5. After all the "bugs" have been worked out, demonstrate the program to your instructor.
6. Finally, be prepared to demonstrate and discuss your solutions with others in the class. Compare your solution to others who selected the same problem.

Activity Analysis

Directions: Circle the correct answer or fill in the blanks with the best answer.

1. Bar coding schemes represent:
 - A. letters
 - B. numbers
 - C. Both A and B
 - D. Neither A nor B
2. Bar coding is used mostly for:
 - A. produce handling
 - B. item relocation
 - C. product identification
 - D. item analysis
3. The bars and spaces of a bar code are:
 - A. the same width
 - B. double width
 - C. half width
 - D. varying widths
4. Next to each step of the system's model, write the correlating part of a bar coding system.

Input:

Process:

Output:
5. Bar coding uses a series of bars and spaces to represent:
 - A. a number ciphers
 - B. a letter ciphers
 - C. alphanumeric ciphers
 - D. all of the above
6. A light pen is an example of a/an _____ device.
7. A bar coding system uses a computer program to:
 - A. produce information
 - B. process a signal
 - C. process information
 - D. reduce information

8. Identify five applications for bar coding.

- 1.
- 2.
- 3.
- 4.
- 5.

69-C

2.10

TELECOMMUNICATIONS
TECHNOLOGY

TELECOMMUNICATIONS TECHNOLOGY

Suggested Learning Objectives

Upon completion of the telecommunications unit, students will be able to:

- A. Define and properly use common telecommunications **terminology** like transducer, multiplexing, uplink, geosynchronous orbit, resolution, and frequency. SC1
- B. Identify basic **applications** for telecommunications technology including providing entertainment; advertising products and services; and gathering, disseminating, and exchanging information.
- C. Describe the basic information, financial, human, natural, and technological **resources** associated with various telecommunication processes and enterprises.
- D. Describe basic telecommunication **processes** like modulation, demodulation, amplifying, scanning, switching, networking, transmitting, receiving, recording, and multiplexing. SC1
- E. Describe the societal and environmental **impacts** associated with telecommunications like land utilization, visual pollution, noise pollution, instant communication throughout the world, crowded radio waves, invasions of privacy, and maintenance of interpersonal relationships with distant friends and relatives. SC2
- F. Describe the major milestones in the **history** and evolution of telecommunication technology including the invention of the telegraph, telephone, radio, transistor, and television; the evolution of telephone exchanges from operators to electronic switching; and the development of cable, fiber optics, and satellite communication links. SS2
- G. Identify and evaluate **career** opportunities relating to telecommunication technology (e.g., radio announcer, sound engineer, telephone installer) based on their interests, talents, and career expectations.
- H. Identify potential **safety** hazards and establish guidelines for safe behavior when using telecommunication technologies. PH3
- I. Describe the network of input transducers, transmitters, links, receivers, and input transducers used in a variety of telecommunications technologies including radio, telephone, and television systems.
- J. Discriminate between analogy and digital signals; describe their advantages, their disadvantages, and how they are used in radio, television and telephone communication systems. SC1
- K. Analyze how radio, telephone, and television systems convert and process visual and/or audio information into electrical and/or electromagnetic waves, transmit them

over long distances, and convert them back to audio and/or visual information people can understand. SC1

- L. Describe the technologies, techniques, and storage mediums used to record and play back audio and/or video information.
- M. Select and defend the best telecommunication technology for solving a given communications problem based on content, privacy, financial, and human considerations. SC2
- N. Evaluate how technologies like radio, telephone, and television have shaped and are influencing our culture and other cultures.
- O. Transmit, record, and receive simple messages using common radio, telephone, and television including tape recorders, video recorders, video camera, citizen band radios, short wave radios, and telephones. LA4
- P. Analyze the role of telecommunications technology in an information era and how a person's ability or inability to obtain or disseminate information will effect their position in society. SC2
- Q. Utilize radio, television, and telephone technology in a socially appropriate and productive manor.

Suggested Learning Activities

1. Discuss the history of electronic communication technology. During a laboratory activity, have students design, build and test a basic telegraph system. Have students encode, transmit, receive, and decode simple messages. Ask students to identify the limitations of the telegraph as a means of communication and how subsequent developments in communication technology address its limitations. Discuss how early forms of electronic communication technology shaped communication patterns and influenced social behavior.
2. Explain how electricity can be used to transmit and receive verbal information. Using electronic components like speakers, switches, and amplifiers, have students design, build and test an intercommunication system. Discuss the applications and limitations of an intercommunication system as means of communication.
3. Introduce students to the concept of transmitting information through an optical material in the form of digital pulses of light. Using flashlights as light sources, acrylic plastic rods as fiber optic cables, and wooden disks to adapt the flashlights to the acrylic plastic rods, have pairs of students make a fiber optic communication system. Have one student from each team use their flashlight to transmit a simple message in Morse Code through the acrylic rod. Have the other team members receive, record, decode and respond to the flashed pulses of light at the other end of the fiber optic link. Discuss how digital and fiber optic technology is making telecommunications more efficient by transmitting more information, using less space, and requiring less maintenance.

4. Discuss how the telephone companies are gradually replacing copper telephone cables with fiber optic cables. Using a commercial or constructed fiber optics trainer, have students build and test an electronic circuit that converts an audio signal to light waves, transmits the lightwaves through a fiber optic cable, and converts the lightwaves back to audio. Ask students to identify the potential implications of replacing copper telephone lines with fiber optic cable. Include topics like new jobs, retraining workers, recycling copper, and better telephone service in the discussion.
5. Explain how laser technology can be used to transmit information from one location to another. Using a laser trainer, have students transmit a recorded message on a laser beam to a receiver. Determine the effects of changing the distance between the laser and the receiver, sprinkling dust across the laser beam, and installing a fiber optic link between the laser and the receiver. Ask students to identify advantages, disadvantages, and possible applications for using laser technology to transmit and receive information.
6. Using several telephones, show students the basic parts of a telephone system. Explain how a telephone system converts sound waves to electrical waves, transmits electrical waves across a link, and converts the electrical waves back to sound waves. Using items like small speakers, telephone cable, and amplifiers, have students build and test a two handset telephone system. Ask students to connect the transmitter speaker from one handset to the amplifier's input terminals and connect the amplifier's output terminals to the receiver speaker on the other handset. Use the same procedure to connect the other speakers and amplifier. Ask students to explain how the telephone system fits in the basic communication model (send, encode, transmit, link, receive, decode, receive, and feedback loop).
7. Introduce students to the concept of switching. Explain how a phone number establishes a circuit between two telephones. Using rotary switches, barrier strips, small amplifiers, and the handsets used in the activity above, have students build and test a switching system that will connect one central handset to a network of handsets. Ask students to describe the impact of a major malfunction in a central switching office on individuals, businesses, and emergency services.
8. Discuss how groups of people in different locations can use teleconferencing technology to communicate with one another at the same time. Using rented or donated teleconferencing equipment, hold a teleconference between two or more schools. Have students discuss the impact of telecommunication technology on society, the school's technology education program, or student organization business. Ask students to identify and evaluate advantages and disadvantages of using teleconferencing. Address issues like industries need to reduce costs, the impersonal nature of communicating over the telephone, and the human need to communicate with people in person.
9. Explain how satellites are used to link distant transmitters and receivers called earth stations. Using commercial or constructed trainers, simulate a satellite communication system using light wave transmitters and receivers. To construct the simulation, use a light wave transmitter to represent a local earth station, a light wave receiver wired to a light wave transmitter to represent a satellite, and a light wave receiver to represent a distant earth station. Align the components and transmit an audio signal through the

simulated local earth station (transmitter), through the satellite (receiver/transmitter), and to the distant earth station (receiver). Discuss the implications of being able to transmit and receive information throughout the world almost instantaneously via satellite.

10. Explain how some satellites act like mirrors in space that reflect radio signals back to earth. Using a laser trainer, have students transmit a recorded message to a receiver by reflecting the beam off a mirror. Ask students to identify the role being played by the laser, mirror, and receiver in the simulation. Discuss how information is transmitted and received via satellite technology.
11. Using a wireless microphone and a portable radio, introduce students to the basic parts of a radio communication system. Explain how radio systems convert sound waves to electrical waves, transmit electromagnetic waves, receive electromagnetic waves, and convert electrical waves back to sound waves. Using commercial or constructed kits, have students build and test simple AM or FM radio receivers and/or transmitters. Ask students to evaluate the role radio plays in their lives.
12. Discuss how various types of two-way radios are used for entertainment, business, and emergency applications. Using citizen band or ham radio equipment, have students transmit and receive information from other radio operators. Have students explain why everyone should follow the rules of appropriate conduct when using a two-way radio. Ask students to describe the role of two-way radio in the event of a major disaster and/or phone system failure.
13. Using a video camera/microphone and television, introduce students to the basic parts of a television communication system. Explain how a television system converts light and sound waves to electrical waves, transmits electromagnetic or electrical waves across a link, receives electromagnetic or electrical waves, and converts electrical waves back to light and sound waves. Using a video camera, recorder, and monitor, have small groups of students design, record, and broadcast a simple message using television technology. Ask students to evaluate the role television plays in their lives.
14. Explain how radio frequencies are regulated and utilized for various communication applications. Using a multiband radio, have students monitor a wide range of radio frequencies including those used for police, business, weather, marine, aviation, entertainment and personal applications. Have students compare and contrast the communication techniques used on each frequency band. Have students explain why radio frequencies have to be regulated, why given frequency bands are used for specific applications, and what would happen if anyone could use any frequency.
15. Discuss the advantages and disadvantages of various telecommunications technologies including radio, television and telephone systems. Ask small groups of students to select and present the best telecommunications technology for addressing a given problem. Possible problems could feature things like advertising a specific product or service, facilitating communications in the event of a natural disaster, and/or providing educational opportunities to people in a remote and underdeveloped area.

Have students evaluate the importance of having access to communication technology at the individual, national and international level.

16. Discuss the various types of businesses associated with the telecommunications industry. Conduct a field trip to or invite a guest speaker from a local radio station, television station, or telephone switching office. Have students ask the industry representative questions about the career opportunities, technology, services, management techniques, and marketing strategies associated with their business.
17. Discuss the milestones in the history and evolution of telecommunication technology. Assign each student a historical event. Using library resources, have students gather information and develop an abstract describing the people, dates, places, and impacts associated with their assigned event. Encourage students to illustrate their abstracts. Post each abstract on a large timeline. Ask students to describe how given events influenced our culture and subsequent technological developments.
18. Discuss the career opportunities in telecommunication technology. Include occupations at the non-skilled, semi-skilled, skilled, technician, and professional levels in the discussion. Using library and guidance resources, have students gather information and present a short written or verbal report about an occupation related to telecommunication technology. Each report should include information about the educational requirements, working conditions, benefits, salary, and advancement potential related to the occupation. Ask students to evaluate the career based on their interests, talents, and career expectations.

TELEPHONE TECHNOLOGY

Introduction

On March 10, 1876, Alexander Graham Bell transmitted "Mr. Watson, come here, I want you" by telephone. Today, there are about 170 million telephones in the United States. In its simplest form, a telephone system is basically a transmitter, link, and receiver.

When you talk into a telephone, you are transmitting. The transmitter is basically a transducer that converts sound waves into electrical waves. The sound waves from your voice cause a thin metal plate called a diaphragm to vibrate. The vibrating diaphragm presses on carbon granules and alters their electrical resistance. The changing electrical resistance creates electrical waves that represent the sound waves.

The electrical signal from the transmitter is sent via the link to their destination. The link is basically the medium used to complete the circuit between the transmitter and the receiver. It can be copper wires or cables, radio waves, and/or optical fiber. The link between the transmitter and the receiver is established when you dial the phone. Dialing an area code connects the transmitter with a geographical region. The next three numbers connect the transmitter with a central telephone office. The last four numbers connect the transmitter with a specific phone.

Like the transmitter, the receiver is a transducer. The receiver converts the electrical waves back into sound waves. The electrical signal flows through an electromagnetic coil and produces a magnetic field. The electromagnetic coil is surrounded by a permanent magnet and is attached to a diaphragm. The magnetic field produced by the coil interacts with the magnetic field from the permanent magnet and causes the diaphragm to vibrate. These vibrations produce sound waves that represent a reproduction of the sender's voice.

This Technology Education Activity will provide students with an opportunity to make a basic telephone system using simple transducers, conductors, switches, and relays.

Materials and Supplies

Each handset will require:

- 2 replacement speakers about 2 1/4" in diameter (the kind used in transistor radios)
- 2 hardboard or acrylic plastic squares 1/8" thick, 3" wide, and 3" long
- 1 softwood square 1/2" thick, 3" wide, and 3" long
- 1 piece of softwood 3/4" thick, 3" wide, and 7" long
- 1 piece of softwood 3/4" thick, 3" wide, and 4 1/2" long
- 4 6' links of conductor telephone cable

A switching system for a seven digit phone number that will accommodate up to 10 phones will require:

- 2 audio amplifiers (Radio Shack No. 277-1008, Graymark kit No. 140, (or similar amplifier)
- 1 DPDT Toggle switch
- 2 double pole, 6 position, rotary switches
- about 50 wire nuts for 18 gauge wire
- 1 sheet of acrylic plastic, 1/8" thick, 8: wide, and 8: long
- 16 pieces of 24 gauge wire about 1 foot long
- 4 2-conductor 1/8" mini phone plugs (only if you use Radio Shack amplifiers)

Activity Procedures

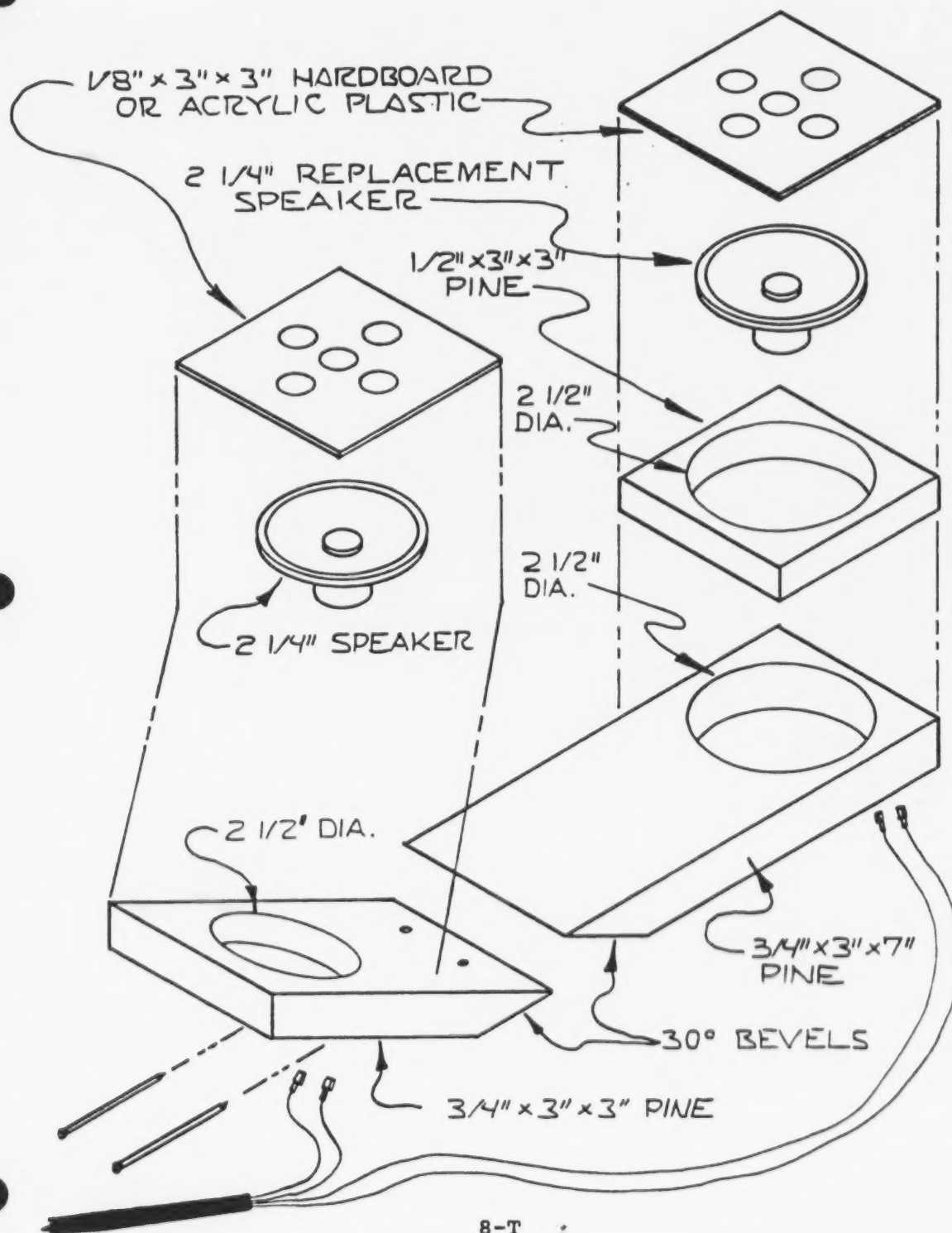
1. In groups of three, begin by making a telephone switching system according to the plans (DR #1-4) and verbal instructions provided by your instructor. It is best to divide the construction process among group members. For example, one member can make the head sets while others make the switch's system.
2. Once completed, assign each phone a number (111-1111). Label each position on the switching system mock-up.
3. Test the system by having one group member call other members at each number and establish two-way communication.

Activity Analysis

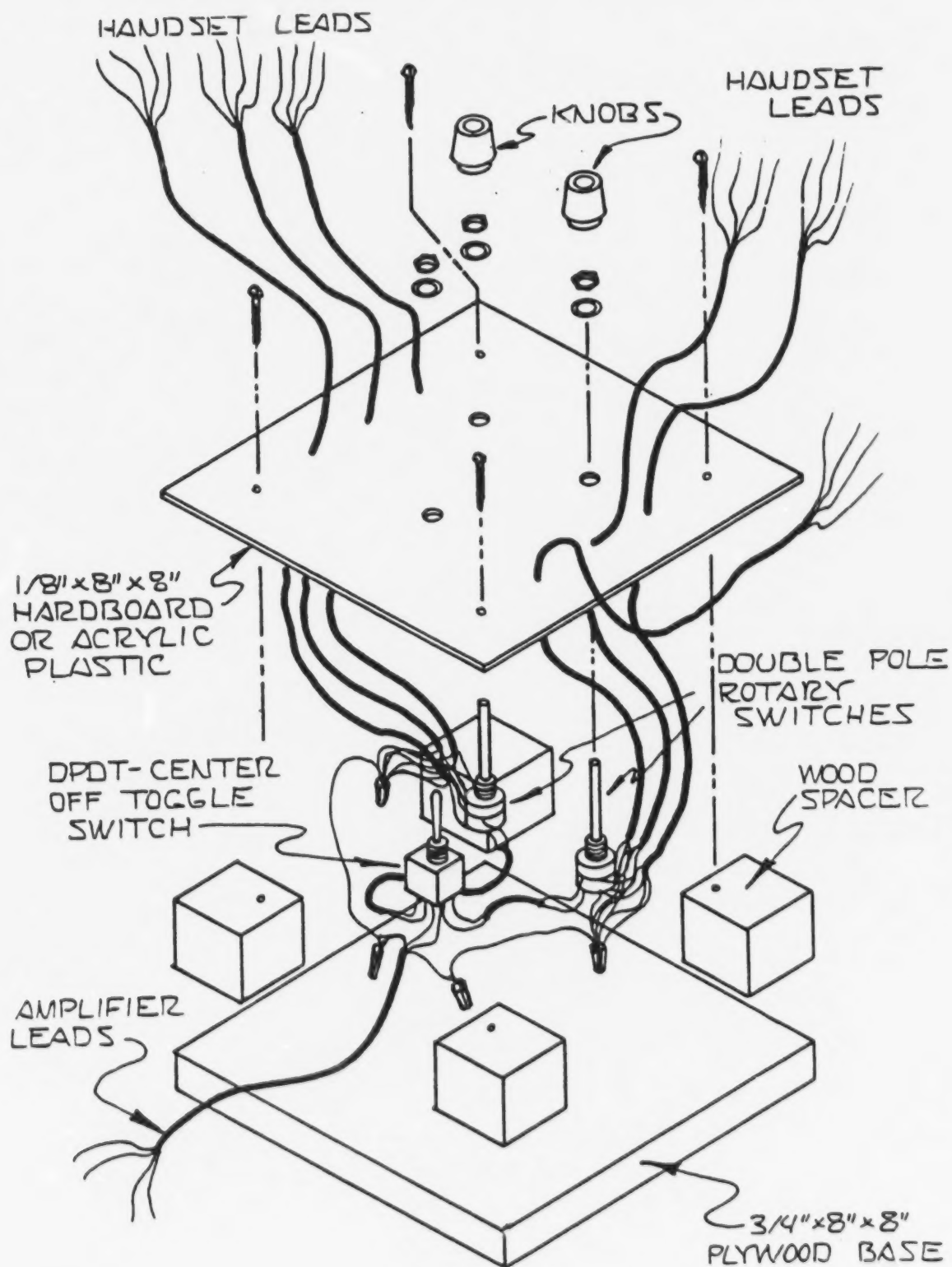
1. What role does each part of a phone number play when establishing a link between the sender and receiver?
 - a. Area code _____

2. Describe how telephone systems carry information from one location to another.

3. List three techniques used to link a sender to a receiver in a telephone system.
 - a. _____
 - b. _____
 - c. _____

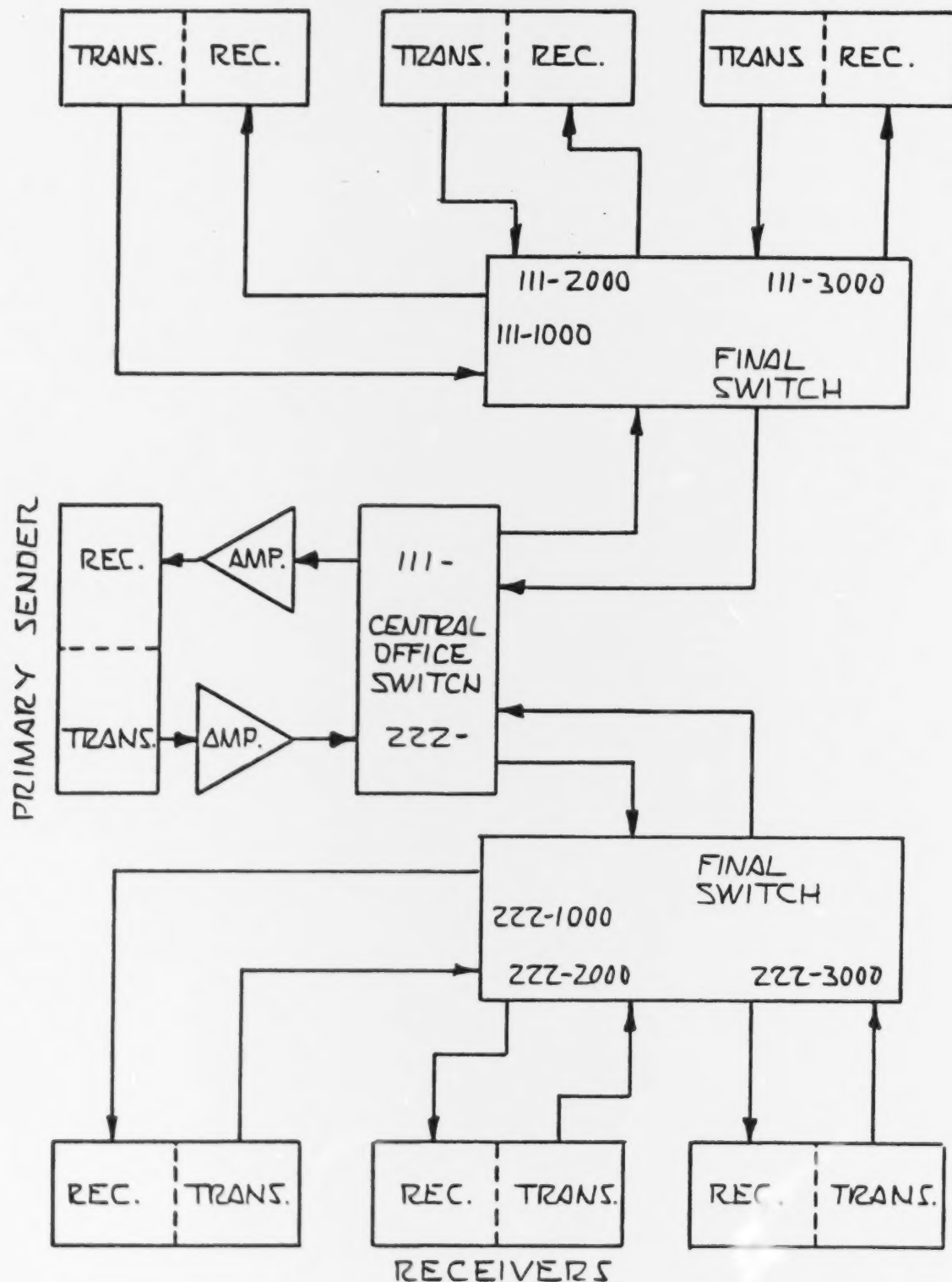
HANDSET PLAN

SWITCHING SYS. PLAN

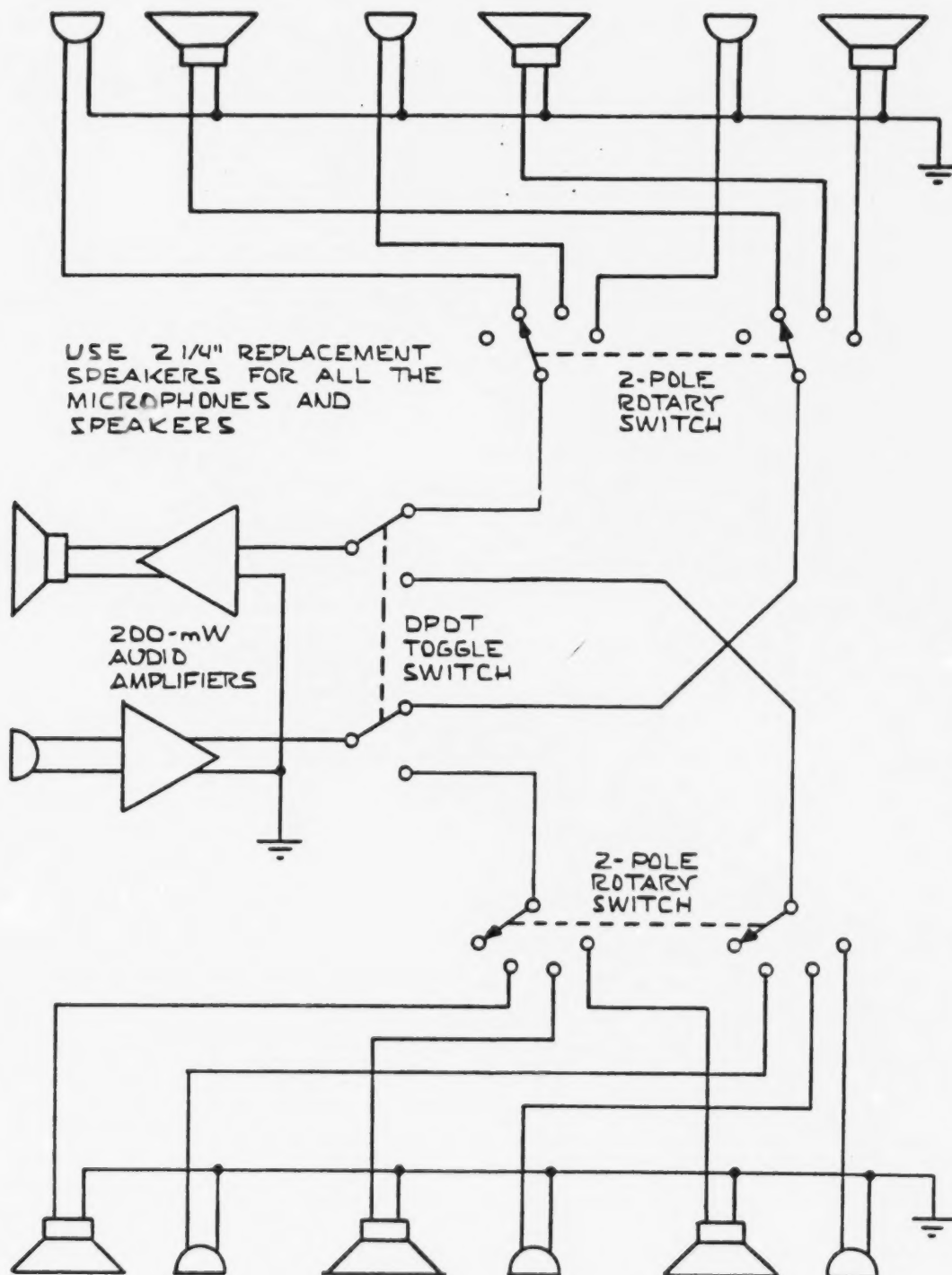


BLOCK DIAGRAM

DR #3



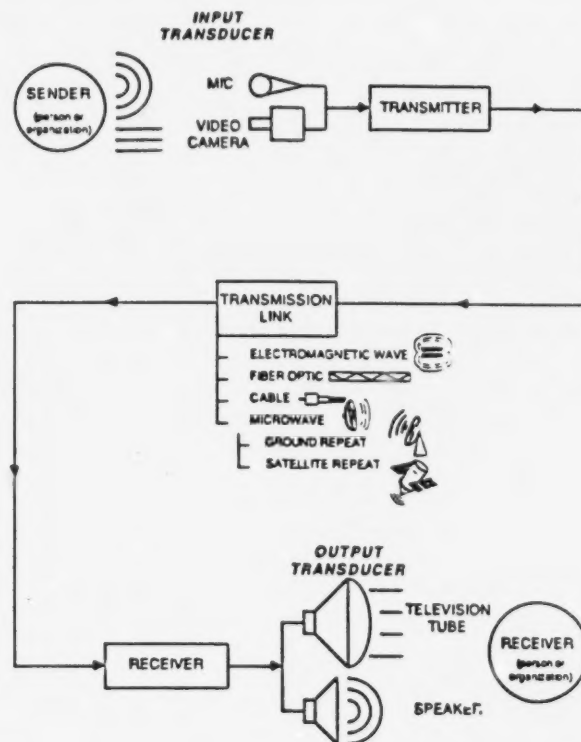
10-T

SCHEMATIC DIAGRAM

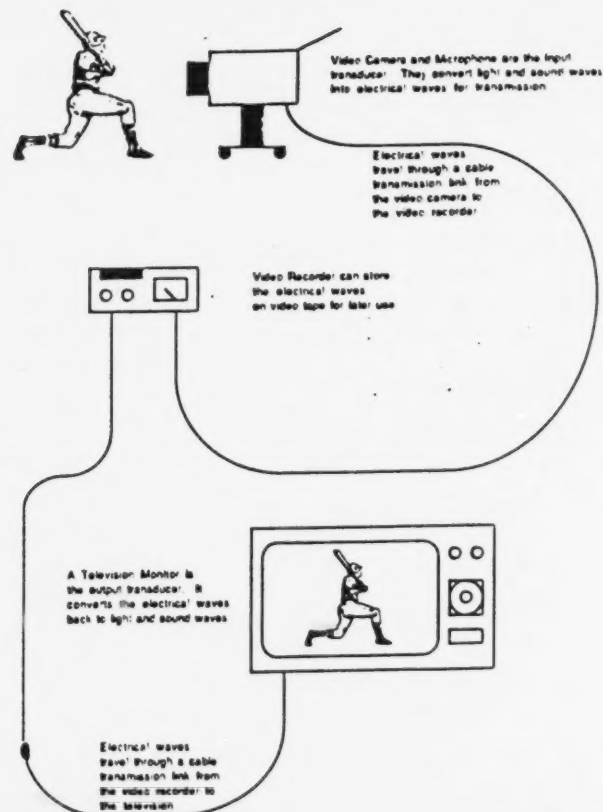
TELEVISION

Introduction

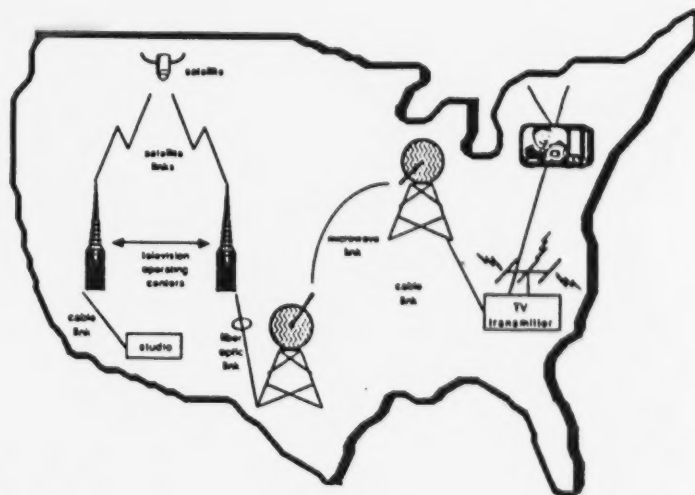
Television is a type of telecommunications where light and sound waves are converted by a transducer (a device that can convert one form of energy to another) into electrical waves for the purpose of transmission. The electrical waves are sent over a transmission link. A second transducer then turns the electrical waves back to light and sound waves to be received by the viewer (see illustration below).



A basic television communications system uses a video camera to convert light waves and a microphone to convert sound waves into electrical waves. The system then sends the waves across a link, which could be one or a combination of a cable link, satellite link, microwave link, or fiber optic link. The electrical waves are then received by a television or video monitor and converted back into light and sound waves, which are then received by the viewer. An added dimension to the system is the video cassette recorder (VCR), which records and stores the electrical waves on video tape for future use (see illustration on next page).



The same principle is used for transmitting television signals from a television studio to the viewer. Whether you are watching the Olympics via satellite or reruns from your local television station, each component in the system must be linked using one or more transmission links (see illustration below). For example, news from the Olympic Games in Korea would be beamed to a satellite to get over the ocean, then back down to a booster in the United States where it may be transmitted by microwave from tower to tower before it reaches the studio from which it is broadcast.



There are many applications for television communication systems in today's world. The most common application of television communication systems is the transmission of news, sitcoms, talk shows, movies, and sports, by the major networks into the standard home television set. Other applications include video conferences, surveillance equipment, home video cameras and recorders, movie video rentals, etc.

This Technology Education Activity will provide the students with an opportunity to experience using a video camera, video recorder, and video monitor as a communications system, and to evaluate the role that T.V. plays in their lives and in society.

Materials and Supplies

To complete the television broadcast each group of students will need:

- video camera
- blank storyboard pages (either commercial or computer generated)
- video monitor
- staging area
- video recorder
- stop watch
- set/prop materials (This list of materials may vary depending on the complexity of the commercial, but some common materials may include:
 - * poster board
 - * markers
 - * rolls of paper
 - * cardboard
 - * tape
 - * rubber cement
 - * scissors
 - * glue sticks
 - * stencils

Optional: Your commercial can be enhanced with several popular animation and graphic software packages.

Creating a Television System:

Activity Procedures

1. Divide the class into three groups.
2. Obtain SH #1 showing components of a television system and a blank television sheet (SH #2), scissors, and a glue stick.
3. Cut out the appropriate symbols needed to complete your television system and glue them down to the correct location.
4. Label each component of the television system.
5. Once all components have been glued and labeled, write a short narrative explaining each process in the space provided.

Problem Statement

The Progress Ad Agency has contracted your advertising department to develop and produce a television commercial for one of the company's biggest clients. Before they award your firm the contract, they would like to see either a thirty or sixty-second pilot commercial. As the media production section of the firm, it is your job to create, write, produce, and film the pilot commercial. Remember, a multi-million dollar contract depends on the creativity and quality of your pilot commercial.

Creating a Television Commercial:

Activity Procedures

1. Divide the class into groups of three or four.
2. As a group, use brainstorming techniques to develop a list of potential commercial ideas.
3. After the list has been generated, narrow the list down to the best three ideas. Remember the topics should be original and in good taste.
4. Obtain three copies of the Developing a Television Commercial worksheet (SH #3) and complete the information for each of the three topics.
5. After your group has completed the information for each of the three topics, vote on the one your group feels will make the best commercial pilot.
6. Once a topic has been selected, assign each member to one of the following jobs:

- **DIRECTOR:**

The ultimate success or failure of the project rests on the director. The director should oversee the progress of the storyboard, sets, lighting, cue cards, and filming. This means the director is responsible for knowing what the actors and technicians are supposed to do, and deciding when they should do it. (Depending on the size of the group and the complexity of the commercial, the director may be forced to assume other job responsibilities.)

- **ACTOR/ACTRESS:**

One major factor in the overall quality of the commercial will depend on the actors'/actress' ability to portray the product at its best. Since reading the cue cards word-for-word will take away from the quality of the commercial, the actors/actresses should have their lines and actions memorized. They should spend time rehearsing their lines and interacting with the props. (Depending on the size of the group and the complexity of the commercial, the actors may be forced to assume other job responsibilities such as developing storyboards, making cue cards, constructing sets, and designing props.)

- **TECHNICIAN/OPERATORS:**

The picture quality of the commercial will depend on various technicians and operators. There are several jobs associated with technicians and operators. One is the camera operator. It is very important that the camera operator be able to take direction from the director, set up recording equipment, focus the camera, use the camera zoom lens, and rotate the camera tripod. It is also very important that the camera operator use smooth fluid motion when filming the commercial.

Technicians are used when constructing sets, setting up lights, staging visual and audio special effects, holding cue cards, making props, and timing the length of the commercial. (Depending on the size of the group and the complexity of the commercial, the responsibilities of the technician and operators may be combined and shared by several group members.)

7. Once the materials for the commercial have been developed, the group should rehearse the whole commercial from the beginning to the end.
8. Modify the commercial in order to stay within the given time limitations if needed.
9. When filming your commercial, you will have three takes. Therefore, if someone or something does not perform properly, keep on going through the whole commercial. Do not stop and start over if at all possible. Once the commercials have been recorded, as a group, select the best one to be graded.
10. Obtain the Commercial Evaluation Sheet (SH #4) from your instructor. As a class, review each group's commercial and select the one that best solves the original problem statement. Use the handout to evaluate each group's commercial.

Activity Procedures

Creating a Television News Broadcast:

1. Divide the class into groups of five or six.
2. Each group member should be assigned to one or more of the following job assignments:
 - **NEWS ANCHORPERSON:**
The news anchorperson is responsible for gathering information, writing a script, and delivering a three to five minute segment on national, state, local, and/or school news. The news anchorperson will need to gather and organize materials from a newspaper or through personal interviews. The news anchorperson should explain the who, what, when, where, and how of the various news stories. He or she will also introduce other segments of the news. News segments should include some type of prop or graphical support.
 - **SPORTS REPORTER:**
The sports reporter is responsible for gathering information, writing script, and delivering a one to three minute segment on national, state, and school sports news. This information should be gathered through newspapers and personal interviews. Make sure each story answers such questions like who, what, when, where, why and how. The sports segment should include at least one prop or graphic.
 - **WEATHER PERSON:**
The weather person is responsible for gathering information, writing the script, and delivering a two to three minute segment on national, state, and local weather. The weather segment should include things like current conditions, national weather patterns, national and local high and low temperature recordings, and extended forecast. This information should be gathered using newspapers, watching television weather broadcast, and gathering information about

current weather conditions. The weather segment should include at least one prop or graphic.

REPORTER:

The reporter is responsible for gathering information, writing the script, and delivering a one to two minute human interest story about a local or school-related topic. This information should be collected through newspapers and personal interviews. Human interest segment should include a prop or graphic.

TECHNICIANS/OPERATORS:

The picture quality of the commercial will depend on various technicians and operators. There are several jobs associated with technicians and operators. One is the camera operator. It is very important that the camera operator be able to set up the recording equipment, focus the camera, use the camera's zoom lens, and rotate the camera tripod. It is also very important that the camera operator use smooth fluid motion when filming the commercial. Technicians are used when constructing sets, setting up lighting, visual and audio special effects, holding cue cards, making props, creating graphics, developing a station logo and call letters, and arranging credits.

OPTIONAL:

Several popular computer software packages can be used to enhance your television production. Animation and graphics programs can be used to add many creative visual effects to your broadcast.

3. Once all the materials for the television news broadcast have been developed, the group should spend time rehearsing each segment of the news broadcast.
4. Modify the news broadcast in order to stay within given time restraints.
5. Record the television news broadcast. Remember to speak clearly and to the camera as much as possible.
6. As a class, evaluate all the television news broadcasts (SH #5). Be able to discuss the following:
 - how editing could have changed or enhanced the production;
 - the effects of television on our lives and society;
 - careers involved in broadcasting in a television message such as camera operators, control room engineers, and video equipment operators.

Activity Analysis

Match the letter of the component on page twenty with the statement that best describes that component on pages one and two of this quiz. Place the matching letter in the space provided before the statement.

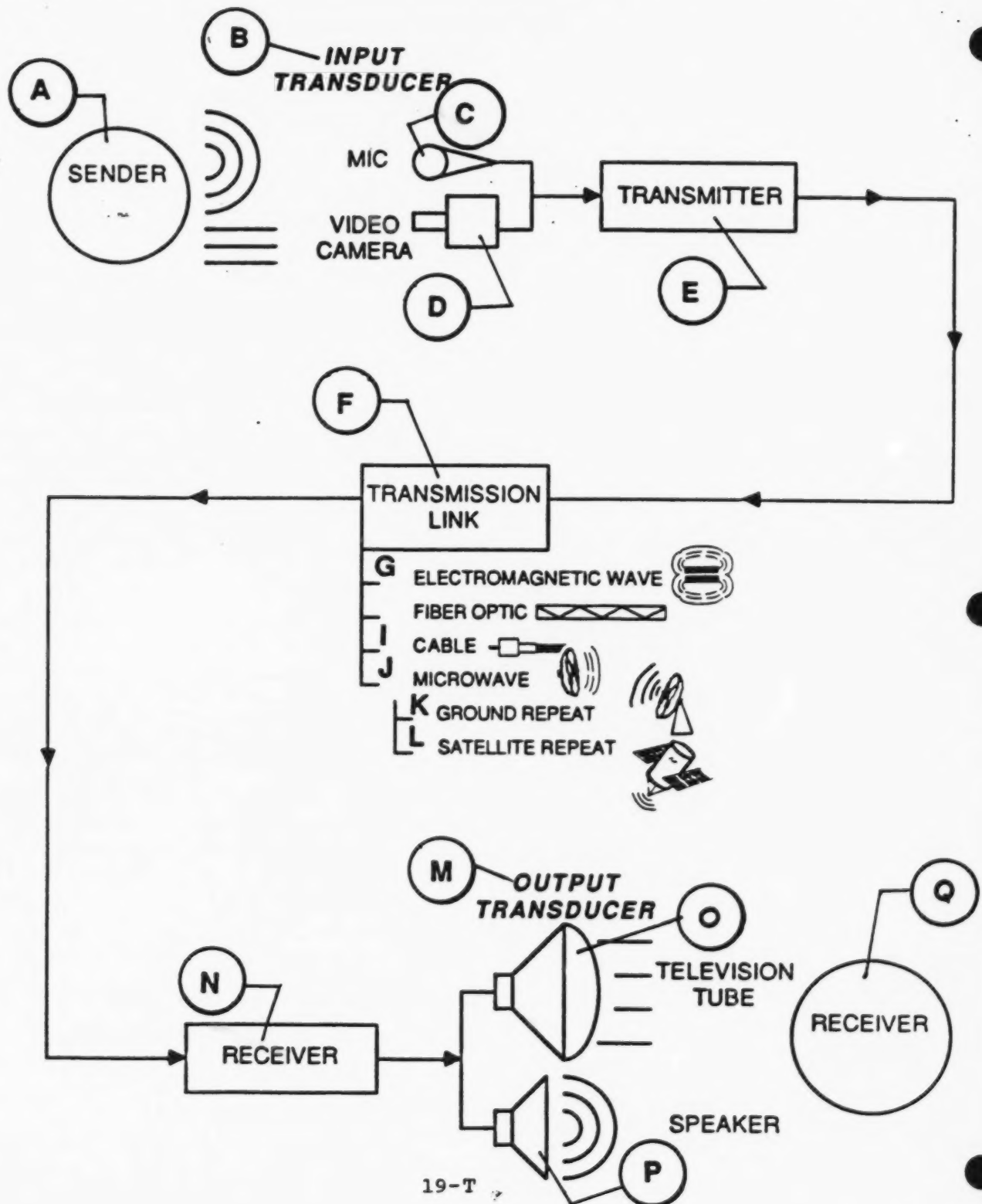
- _____ 1. The group of components that change the electrical waves back into light and sound waves.
- _____ 2. The component that sends the electrical waves over the transmission link.

- ___ 3. The component that orbits around the earth and distributes television signals in the form of microwaves.
- ___ 4. The person or organization that receives the message being broadcast.
- ___ 5. The transmission link that uses light to transmit the television signal.
- ___ 6. The component that changes light waves into electrical waves.
- ___ 7. The component that changes electrical waves into sound waves.
- ___ 8. The component that carries the electrical signal from the transmitter to the receiver.
- ___ 9. The group of components that change the light and sound waves into electrical waves.
- ___ 10. The component that changes sound waves into electrical waves.
- ___ 11. The component that changes electrical wave into light waves.
- ___ 12. The transmission link that carries the television signal that is received by a television antenna.
- ___ 13. The transmission link that uses satellite dishes to send and receive a television signal.
- ___ 14. The component that receives the electrical signal from the transmitter.
- ___ 15. The transmission link that uses a wire to send a television signal.
- ___ 16. The person or organization that sends the message being broadcast.
- ___ 17. The component that is positioned on earth and distributes television signals in the form of microwaves.

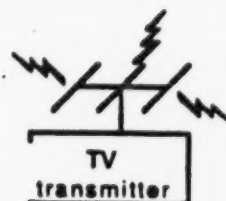
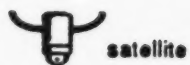
Complete the following questions:

- 18. List two examples of technical careers involved in broadcasting a television message.
 - A.
 - B.
- 19. List five ways that television systems affect your life.
 - A.
 - B.
 - C.
 - D.
 - E.

TELEVISION QUIZ DIAGRAM



studio



television
operating
center



television
operating
center



fiber optic
link



cable
link



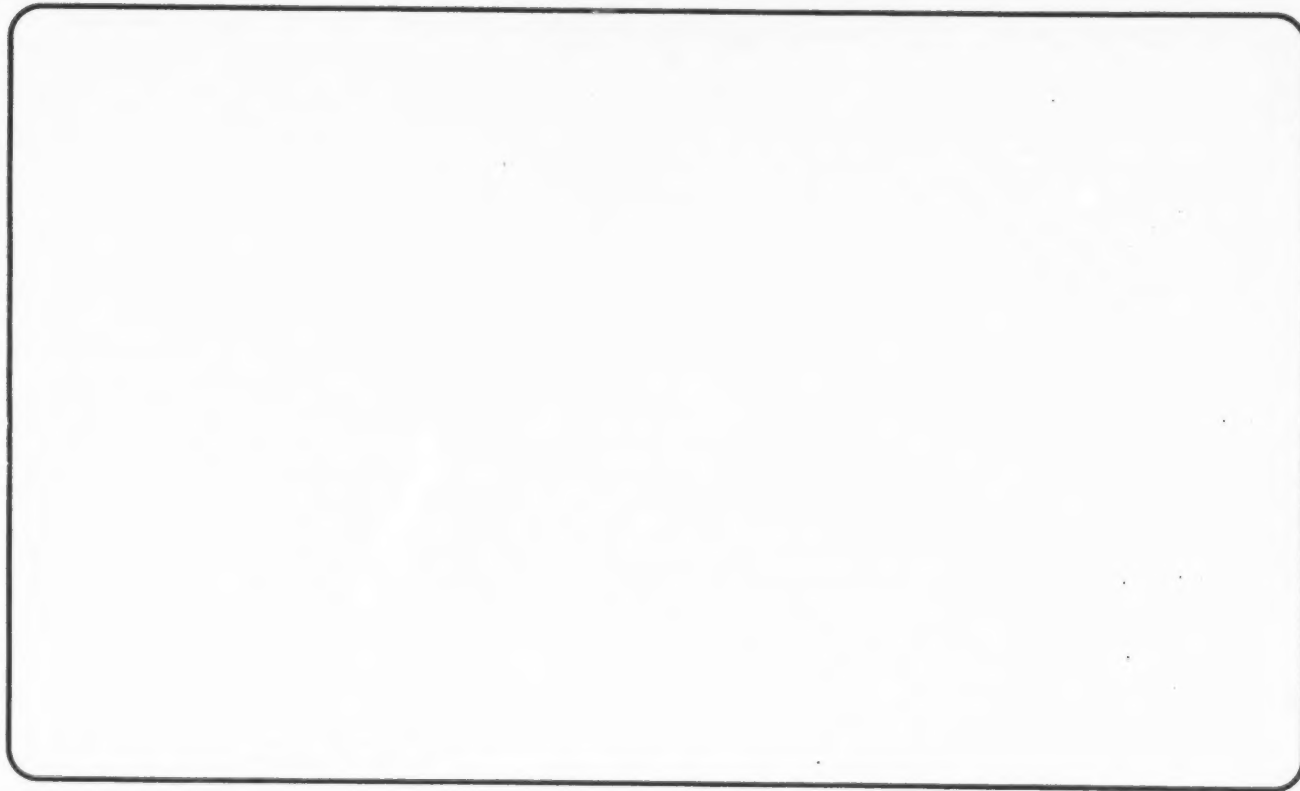
satellite
link



microwave
link



TELEVISION SYSTEM WORKSHEET



Descriptive Narrative:

SH #2

21-T

**DEVELOPING A TELEVISION COMMERCIAL
WORKSHEET**

1. What is the theme or main idea behind your commercial?

2. Develop a catchy slogan or key phrase to describe your topic or product.

3. What is the setting for your commercial?

4. Make a list of the props and materials needed to create your commercial.

5. Make a list describing the type of action that will take place in the commercial.

TELEVISION

Evaluation for Television Commercials

Commercial's main theme _____

Commercial's catchy slogan or key phrase _____

Broadcast Evaluation

(10 pts. each)

- I. Script content was appropriate for commercial _____
- II. Back drops and sets were appropriate for commercial _____
- III. Storyboards and cue cards were prepared properly _____
- IV. The commercial was in focus _____
- V. Camera movements were smooth and fluid _____
- VI. Actors/actresses, props, and/or products were properly framed with the picture _____
- VII. Commercial showed good use of visual and audio special effects. _____
- VIII. Actors/actresses were well rehearsed and did not depend on cue cards. _____
- IX. Actors/actresses provided appropriate voice projection _____
- X. The commercial stayed within the designated time limits _____

Comments: _____

TELEVISION

SH #5

Evaluation for Television News Broadcast

Broadcast Evaluation

(10 pts. each)

- | | | | |
|-------|---|----------|-------|
| I. | Script content was appropriate for each news segment | News | _____ |
| | | Sports | _____ |
| | | Weather | _____ |
| | | Reporter | _____ |
| II. | Graphics and sets were appropriate for each news segment | News | _____ |
| | | Sports | _____ |
| | | Weather | _____ |
| | | Reporter | _____ |
| III. | The broadcast was in focus | | _____ |
| IV. | Camera movements were smooth and fluid | | _____ |
| V. | Anchorpersons, props, and/or sets were properly framed with the picture | | _____ |
| VI. | Broadcast showed good use of visual and audio special effects. | | _____ |
| VII. | Anchorpersons were well rehearsed and did not depend on cue cards. | News | _____ |
| | | Sports | _____ |
| | | Weather | _____ |
| | | Reporter | _____ |
| VIII. | Anchorpersons provided appropriate voice projection | News | _____ |
| | | Sports | _____ |
| | | Weather | _____ |
| | | Reporter | _____ |
| IX. | The commercial stayed within the designated time limits | News | _____ |
| | | Sports | _____ |
| | | Weather | _____ |
| | | Reporter | _____ |

Comments: _____

FIBER OPTICS

Introduction

In its simplest form, a telephone system is basically two phones linked together with a copper wire. Each phone is basically a transmitter and a receiver. When you want to send a message, you talk into the phone, your voice is converted into an electrical signal, copper wires carry the electrical signal to a receiver, and the receiver converts the electrical signal back into your voice.

There are now about 170 million phones in the United States. As the number of phones grew, telephone companies found it very difficult to install and maintain the network of copper wire that connected all our phones. They needed to develop new ways of carrying phone conversations.

Today, several means of transmission are being used. A long distance phone message may make only part of its journey by wire or cable. During its journey it may be converted into radio waves (microwaves). The radio waves are sent from one tower to another through a radio relay system or a communications satellite. There is still another way to carry a telephone conversation.

Long distance and local calls can now be converted into pulses of light by using fiber optics. Fiber optics is an area of communication technology that deals with the transmission of light through an optically transparent material. Optical fibers are typically made of glass, are about 0.004 and 0.008 inches in diameter, and are covered with a protective cladding. If you shine a light in one end of an optical fiber, it will appear at the other end. As the light travels through an optical fiber, it is constantly striking the inside walls of the materials and being reflected back at shallow angles. This internal reflection allows light to travel through the optical fiber even if it is bent around a corner.

The most common application for fiber optic technology is telecommunications. Using fiber optic technology, a phone conversation is electronically converted into pulses of light, transmitted through the fiber optic cable, and then converted back into sound.

The primary advantage of using optical fiber is it can carry hundreds of times more phone conversations than copper wire. While one pair of copper wires can carry about thirty phone calls, an optical fiber can carry up to 1,900 telephone calls at one time. Because optical fiber does not conduct electricity and is not affected by electromagnetic waves, it can be used in electrically hostile environments like factories and power plants. Because of its capacity to carry information, optical fiber can also be used to carry television and radio signals and computer data.

This Technology Education Activity will provide students with an opportunity to experience using light as a communication medium. Using Morse Code, students will convert a simple message into light pulses, transmit it through a fiber optic-like material, convert the light pulses back into the message, and provide appropriate feedback.

Materials and Supplies

Each team will need:

- 2 PVC plumbing caps with a 2 3/8" internal diameter or 2 wooden disks about 3/4" thick and 3" in diameter.
- 1 length of 1/4" acrylic plastic rod at least 16" long.
- 1 flashlight
- 600 grit wet/dry sandpaper
- access to a polishing wheel

Activity Procedures

1. Make a fiber optic link according to the plan and verbal instructions (see DR #1). For best transmission, make sure to polish the ends of your acrylic plastic rod smooth. Start by placing your wet/dry sandpaper on a flat surface. Rub the end of the acrylic rod on the sandpaper until it is free of scratches. When you have finished sanding, polish the ends of the acrylic rod on a polishing wheel. Next, fasten a PVC or wooden cap on each end. If you need to use glue, make sure you keep the polished ends of the acrylic rod free of glue.
2. Decide who is going to be the sender and who is going to be the receiver.
3. SENDER: Write a simple message that will require a response. For example, "How old are you?" Do not let your partner know what the message will be.

SENDER: Using SH #1, convert your message into Morse Code. For example:

HOW - - - . - -
OLD - - - - - .
ARE . - . - . .
YOU - - - - - - - . - -
?

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

4. **SENDER:** Use the flashlight to transmit your message in Morse Code. For the best transmission, hold the flashlight against the cap. Transmit dots for one second and dashes for about three seconds. Pause for about five seconds between words. Do not use verbal communication during your transmission.
5. **RECEIVER:** While the sender is transmitting, record the light pulse as dots and dashes. When the sender has finished transmitting, decode the dots and dashes back into the original message.

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

6. **RECEIVER:** Determine an appropriate response to the sender's message, put it into Morse Code, and transmit your response to the sender using the flashlight.

_____	_____
_____	_____
_____	_____

7. **SENDER:** While the receiver is transmitting a response, the sender should record the light pulse as dots and dashes. When the transmission is completed, decode the dots and dashes back into the original message.

_____	_____
_____	_____
_____	_____

8. Compare the sender's message with the receiver's response. If the message and the response do not make sense, identify what went wrong, and try again. If you were able to communicate successfully, clean up your workstation, staple your lab sheets together, and turn them into your teacher for evaluation.

Activity Analysis

1. Describe how fiber optic cables are used to transmit messages.

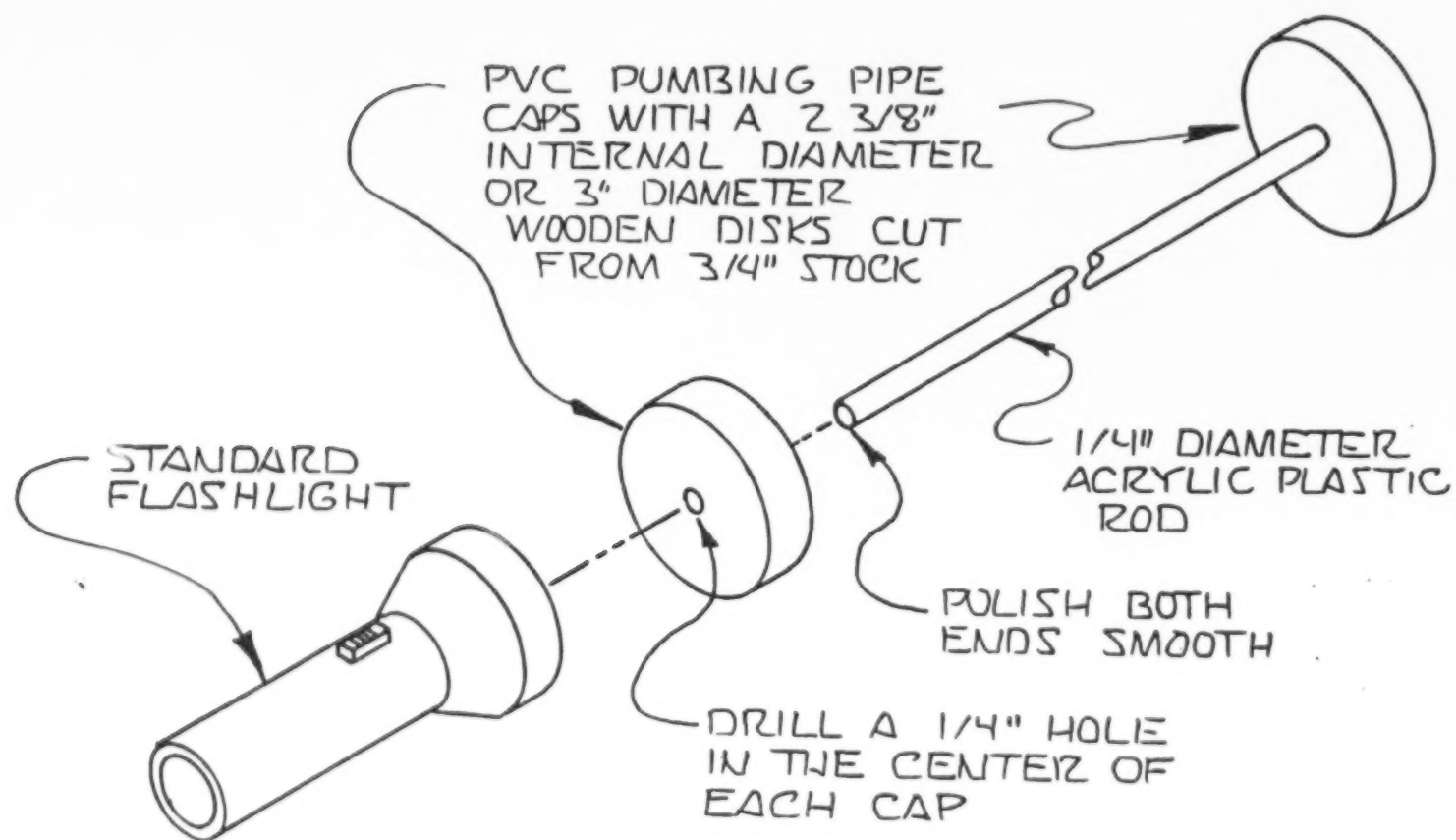
2. Explain why many telephone companies are switching from copper wire transmission lines to fiber optic cable transmission lines.

3. In this activity, the acrylic rod represented:
 - A. input device
 - B. transmitter
 - C. fiber optic link
 - D. Receiver

MORSE CODE

A	..	(di-dah)
B	....	(dah-di-di-dit)
C	....	(dah-di-dah-dit)
D	...	(dah-di-dit)
E	.	(dit)
F	....	(di-di-dah-dit)
G	---	(dah-dah-dit)
H	....	(di-di-di-dit)
I	..	(di-dit)
J	-	(di-dah-dah-dah)
K	---	(dah-di-dah)
L	....	(di-dah-di-dit)
M	--	(dah-dah)
N	..	(dah-dit)
O	---	(dah-dah-dah)
P	---	(di-dah-dah-dit)
Q	-	(dah-dah-di-dah)
R	...	(di-dah-dit)
S	...	(di-di-dit)
T	-	(dah)
U	...	(di-di-dah)
V	-	(di-di-di-dah)
W	---	(di-dah-dah)
X	-	(dah-di-di-dah)
Y	-	(dah-di-dah-dah)
Z	....	(dah-dah-di-dit)
1	-	(di-dah-dah-dah-dah)
2	-	(di-di-dah-dah-dah)
3	-	(di-di-di-dah-dah)
4	-	(di-di-di-di-dah)
5	.....	(di-di-di-di-dit)
6	.....	(dah-di-di-di-dit)
7	.....	(dah-dah-di-di-dit)
8	.....	(dah-dah-dah-di-dit)
9	.....	(dah-dah-dah-dah-dit)
0	.....	(dah-dah-dah-dah-dah)
Period	.....	(di-dah-di-dah-di-dah)
Comma	.....	(dah-dah-di-di-dah-dah)
Question	.....	(di-di-dah-dah-di-dit)

FIBER OPTIC LINK



DR #1

**Illinois
State Board of
Education**

100 North First Street
Springfield, Illinois 62777

Thomas Lay Burroughs, Chairman
State Superintendent of Education

Robert Leininger
State Superintendent of Education

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10-90